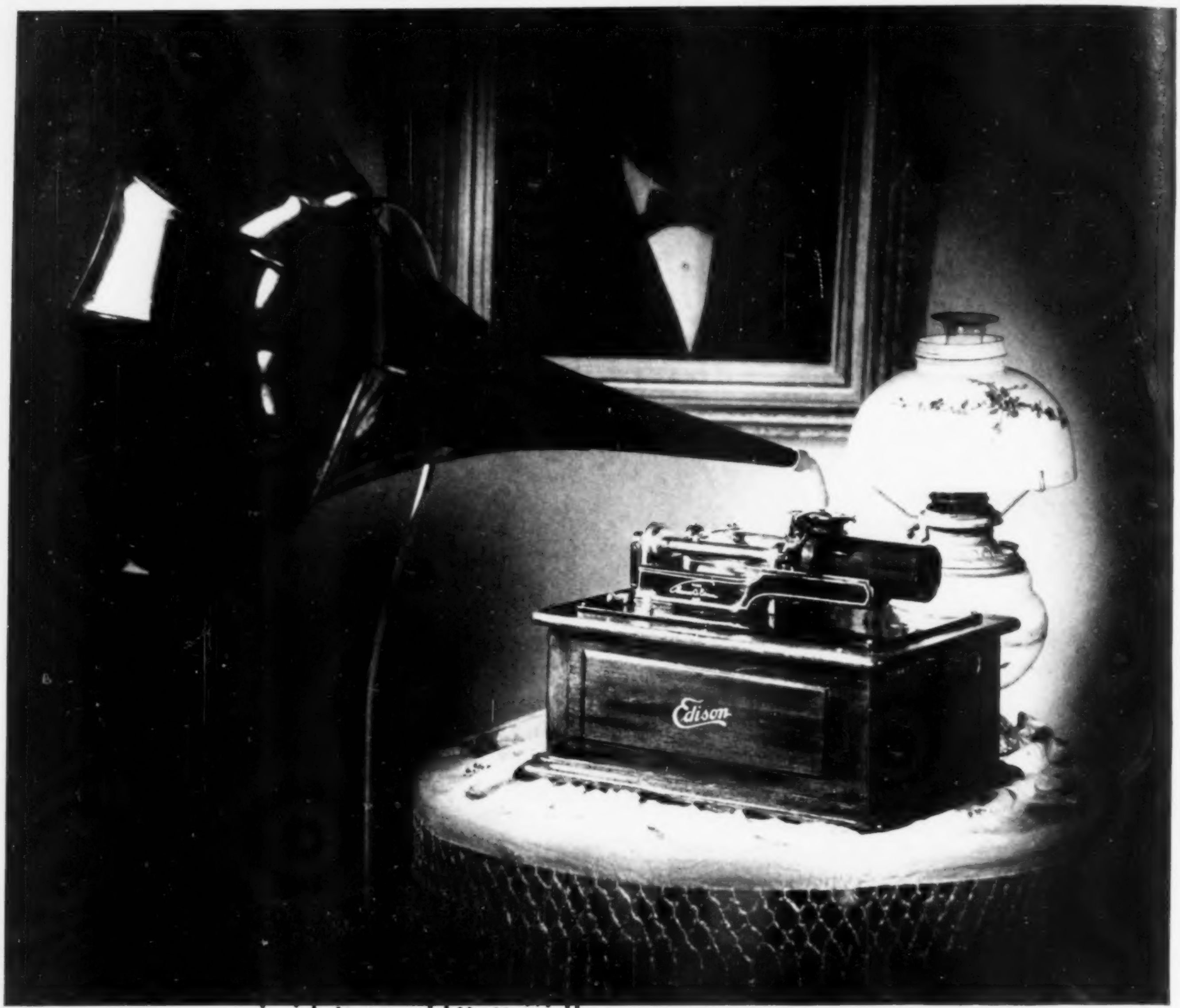
MODERN PLASTICS

SEPTEMBER 1941



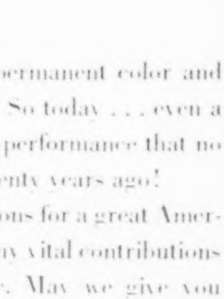
Singing Lessons For Talking Machines!

EVER SINCE Edison's miracle of coaxing a box to talk... sound engineers have worked on the phonograph with all the lavish care that any Opera impresario ever devoted to his voice "discovery." For the latest improvements, the laurel now goes to the engineers of Webster Electric Company. To achieve today's crystal clear reproduction . . . they sought a completely new material for the tone-arm of your phonograph. A *non*-reverberating material—unlike any previously used.

The solution? A Durez plastic!

Not only *non*-reverberating . . . it was found that the crystal and chuck mounting could be molded directly into the arm with Durez, thereby eliminating undesirable tone-arm resonance. Durez also offered the advantage of economical, one-piece precision molding . . . with the permanent color and finish included in the original molding! So today . . . even a modestly priced instrument gives you a performance that no amount of money could buy . . . only twenty years ago!

This is how Durez opens up new horizons for a great American industry. Yet it is but one of the many vital contributions that Durez makes to industry at large. May we give you the facts?



LEARN WHAT DUREZ IS DOING FOR OTHERS *How Durez plastics have helped many leading manufacturers make better products and boost sales is told in a new booklet, "It's A New Business Custom." It's interesting reading and you may find it valuable reading. A request on your letterhead will bring your copy by return mail.*

DUREZ PLASTICS and CHEMICALS

PLASTICS THAT FIT THE JOB

DUREZ PLASTICS & CHEMICALS, INC. **DUREZ** 129 WALCK ROAD, N. TONAWANDA, N.Y.

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modern plastics

SEPTEMBER 1941

VOLUME 19 NUMBER 1

IN THIS ISSUE

Vitally important news to the industry direct from Washington to you is contained in this issue. Turn to insert between pages 44-45 for the three complete orders covering priorities regulating allocation of formaldehyde under orders issued by OPACS and OPM. The allocation program has segregated the non-defense uses of molding compounds, plastics, adhesives and miscellaneous resins where formaldehyde is the basic ingredient.

OCTOBER

Next month we are presenting a business equipment story based on a questionnaire sent to 20 leading business machine manufacturers which reveals a marked trend towards plastics. You will find detailed descriptions of important and interesting re-design jobs.

• GENERAL INTEREST

• TECHNICAL SECTION

• NEWS AND FEATURES

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"The Eyes have IT"

...Thanks to Du Pont "PYRALIN"

MUCH of the credit for making Milady's glasses wearable instead of just bearable goes to Du Pont "Pyralin" cellulose nitrate plastic. The first optical frames made of this light, colorful plastic were so stylish, so attractive and so practical that they caught on immediately—and they've been catching on ever since!

Today these sturdy frames are particularly important. Steel, aluminum and nickel are no longer readily available for metal frames. But optical manufacturers need not worry! "Pyralin" is light, easily styled, and non-irritating to the skin. And, besides protecting expensive lenses from breakage, it blends more attractively with the wearer's skin or, for some feminine purposes, with the wearer's costume.

From eye-glasses to automobiles, Du Pont plastics are just as indispensable as such basic materials as wood and metal. *But*, they're not "substitutes," because they bring new beauty, new performance and new economies to these products. Experimental samples of Du Pont plastics and our experienced technical service are at your disposal. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J.

"Pyralin" is Reg. U. S. Pat. Off.

A STATEMENT BY DU PONT ABOUT PLASTICS...

● Defense requirements and unusual commercial demands exceed the supply of some Du Pont plastics. National Defense orders will get preferred attention, of course. But Du Pont is bending every effort to satisfy commercial and replacement needs. Shortages of equipment and raw materials necessarily limit this effort.

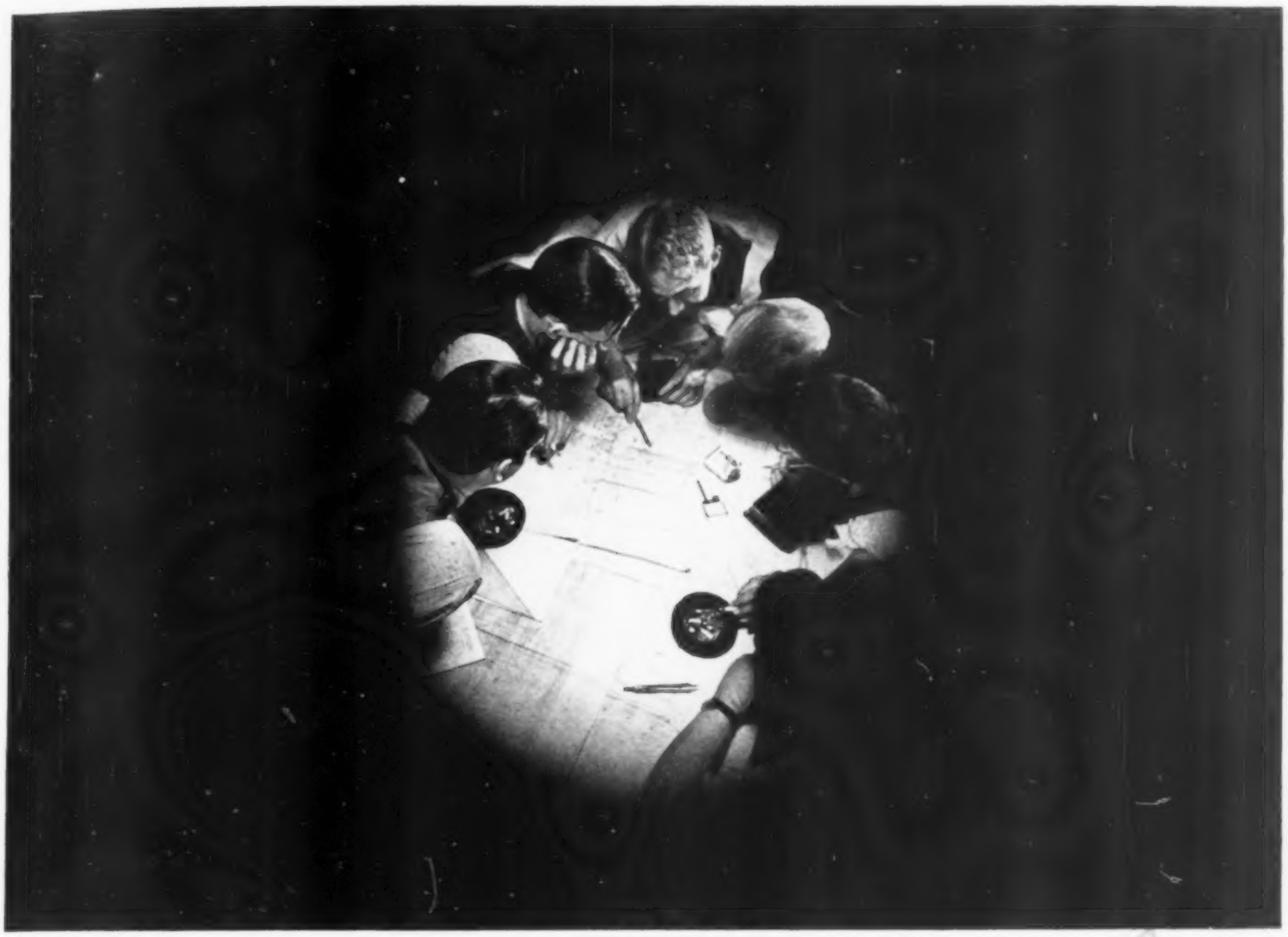
Du Pont is also instituting a broad research and development program. We believe that from this program will come improvements in existing plastics and the creation of entirely new types with new and valuable properties. The results of this research will be reported to you as they develop.

Stories of Du Pont plastics applications and developments will continue to appear in advertisements. We hope you will find it helpful to apply this information to your present and future needs. Meanwhile, experienced Du Pont technicians are ready to devote their knowledge and facilities to your product problems.

DU PONT

REG. U. S. PAT. OFF.

PLASTICS



$0 A YEAR MEN

Experienced Marblette technicians are at your service with free counsel to help you speed up production for defense, and relieve pressure on your technical staff.

Today, with defense work occupying so many man hours and brain hours, Marblette more than ever is anxious to cooperate with you. As our contribution to America's defense program, therefore, we offer you the assistance of our own competent research and development men.

The knowledge and experience of this talented technical staff can help you speed up defense production, as well as fabrication of essential materials, by suggesting ways to simplify procedures, prevent delays, mistakes and waste.

* * *

MARBLETTE, *a pure Phenolic resin without fillers, is available in sheets, tubes, rods and special castings . . . hundreds of colors in translucent, opaque, clear and mottled tones.*

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For Today *And* Tomorrow

BIRDSBORO
HYDRAULIC PRESSES

Birdsboro Hydraulic Presses are capably meeting today's exacting production demands in America's rapidly growing plastics industry.

Along with doing today's jobs well, Birdsboro multiple platen sheet and general molding presses provide security for the future with flexibility and ease of control that will more than measure up to tomorrow's needs.

BUILDERS OF

Hydraulic Presses • Special Machinery
Crushing Machinery • Rolls
Steel Mill Equipment

BIRDSBORO
Hydraulic Presses

THE BIRDSBORO STEEL FOUNDRY AND MACHINE COMPANY • PLANTS AT BIRDSBORO AND READING, PA.

More Light on Product Improvement

Injection molded plastics modernize products with rich color, brilliant lustre and all the other advantages of the proper application of thermoplastics. We may be able to help you, too . . . Our engineers are at your service. No cost or obligation, of course. Just write for information.

These plastic lamp base parts show how injection molded plastics effect product improvement. Precision molded in the desired color, they eliminate costly finishing operations and replace metals, so vitally important for defense. Plastics may solve your problems, too.

Write for your copy of our catalog. It contains valuable information, data and illustrations about Thermoplastics.

Injection molders of Tenite; Lucite; Lumarith; Plastacele; Crystallite; Vinylite; Polystyrene and other Thermoplastic Materials.

ELMER E. MILLS CORPORATION

Custom Injection Molding Exclusively

816 W. VAN BUREN STREET CHICAGO, ILLINOIS

The defense program calls for speed and more speed in production. Labor must be conserved. Material waste and time loss must be avoided.

Stokes Automatic Molding Machines (patented) fully meet the requirements of this program.

- Automatic Molding enables you to get into production, quickly. Molds with few cavities, quickly made, produce parts as required to maintain needed output.
- Molding labor is saved. Machines are completely automatic.
- Tool-makers' time is saved. Automatic molds are completed and ready for use weeks ahead of big multiple-cavity molds . . . and tool steel is saved.
- Molding time is saved. Cycles are reduced 50% or more in many cases. Output per cavity is proportionately increased.
- Material is saved. 8% to 10% or more. Every charge of powder is accurately metered.
- Finishing and Assembly Labor are Saved. Moldings are uniform, accurate, with thin flash.

In Automatic Molding production is high, 10,000 or more parts per week from a single-cavity, because every split-second of time is saved and operation is continuous, 24 hours a day and 7 days a week.

Moldings are made only as required. Therefore, inventories are small and, when necessary, parts can be redesigned and put into production quickly, at minimum cost, and without inventory loss.

If you need plastics parts for defense Automatic Molding should help. Want more information?

•

F. J. STOKES MACHINE COMPANY
5994 Tabor Road Olney, P. O. Philadelphia, Pa.
Representatives in New York, Chicago, Cincinnati, St. Louis, Cleveland, Detroit
Pacific Coast Representative: L. H. Butcher Company, Inc.

F. J. Stokes MOLDING EQUIPMENT

FJS Est. 1895

ALMOST everything but the rubber blades on this f
is made of sleek tan and brown Durite. As the
keeps the windshield clean of moisture and circulates fr
air through the interior of the car, the streamlined Du
housing withstands the twin strains of heat and electri
without faltering. The finish is integral with the article its
will never peel, chip, dent or fade.

This is another of the many applications of beautiful, str
Durite—the only phenol-furfural plastic.

Molded by: The General Industries Co., Elyria, Ohio

DURITE PLASTICS

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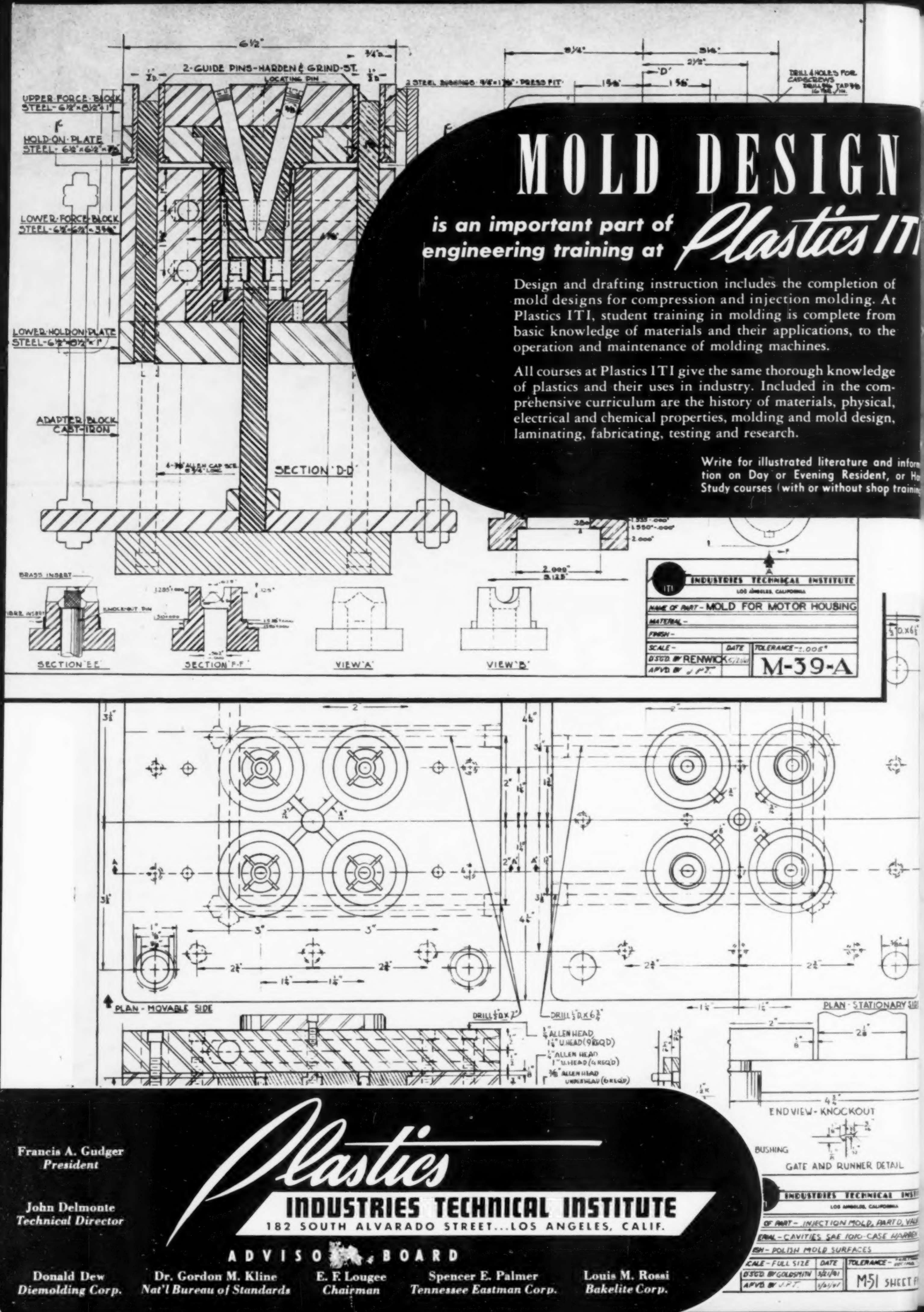
FRANKFORD STATION, P. O., PHILADELPHIA, PA.


UPPER FORCE BLOCK
HOLD-ON PLATE
LOWER FORCE BLOCK
LOWER HOLD-ON PLATE
ADAPTER BLOCK CAST-IRON
SECTION 'D-D'
SECTION 'E-E'
SECTION 'F-F'
VIEW 'A'
VIEW 'B'
INDUSTRIES TECHNICAL INSTITUTE
LOS ANGELES, CALIFORNIA
NAME OF PART - MOLD FOR MOTOR HOUSING
DSGD BY RENWICK
M-39-A
PLAN - MOVABLE SIDE
PLAN - STATIONARY SIDE
END VIEW - KNOCKOUT
BUSHING
GATE AND RUNNER DETAIL
POLISH MOLD SURFACES
SCALE - FULL SIZE
M51

IT
MAKES THEM
STOP
TO
LOOK
AND
LISTEN

LUMARITH does it again! Built to please the ear, this smooth new Detrola portable catches the eye as well—with case and dials molded of Lumarith in rich, contrasting colors.

Light in weight—yet with high impact strength to protect the mechanism within—Lumarith is the ideal material for portable radios and similar products.

Lumarith is, in fact, the all around plastic. But the current problem is that there is not enough Lumarith to go 'round.

Lumarith like so many other important materials is serving national defense in two ways—direct use in defense items and products essential to defense.

So, today, when we say *"Get in touch with Celluloid"* we have in mind advising you as accurately as possible on the raw material situation in the event we are unable to meet your needs immediately.

Molding Powder Division, CELLULOID CORPORATION, 180 Madison Avenue, New York City. Est. 1872. Sole Producer of Celluloid, Lumarith, and Lumarith Protectoid. (Trademarks Reg. U. S. Pat. Off.)

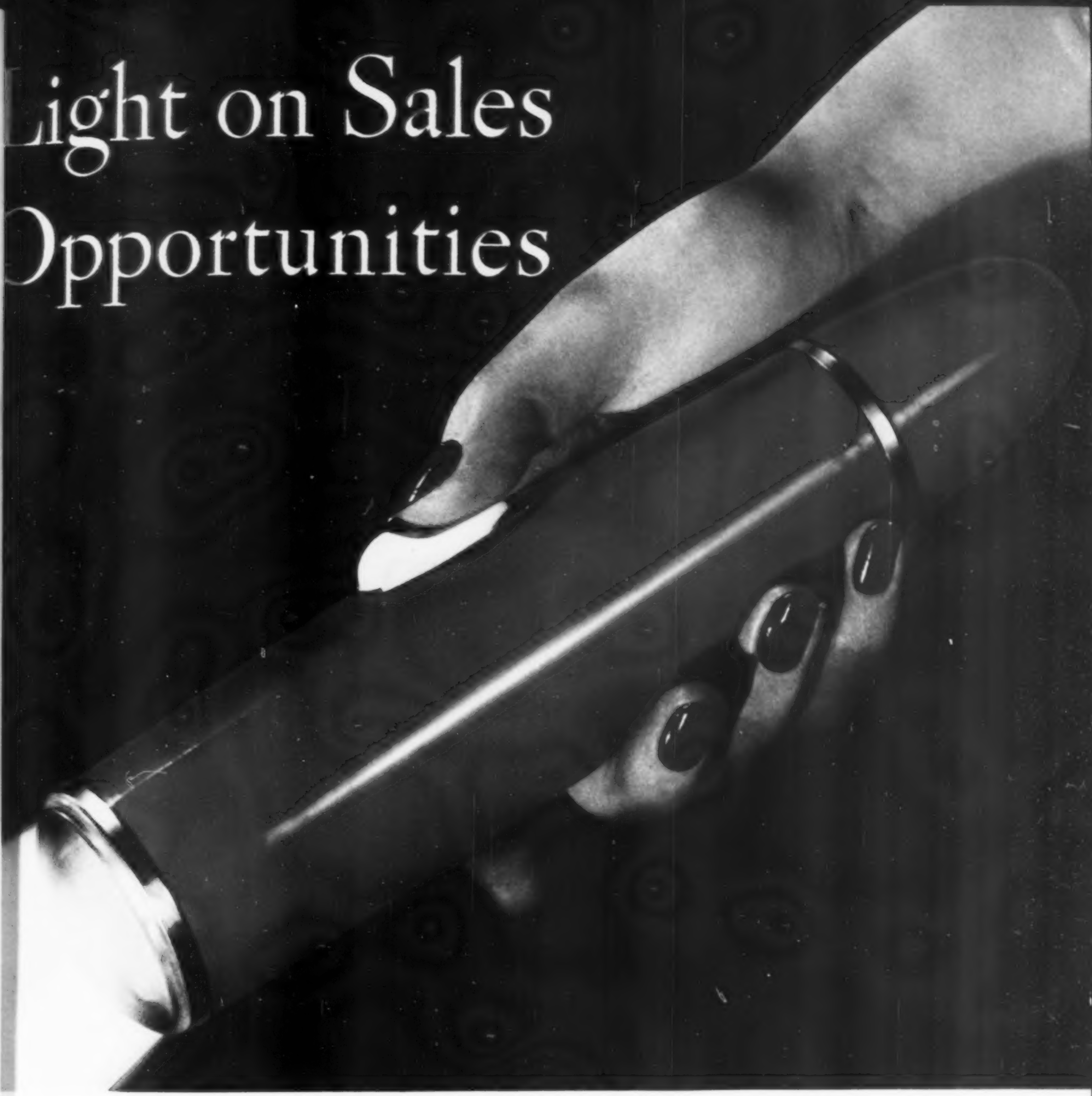
LUMARITH
REG. U. S. PAT. OFF.

When you think of plastics, think of headquarters . . . the "Grand-daddy of them all" . . . and

Get in touch with CELLULOID

...also Headquarters for Transparent PACKAGING MATERIALS

ight on Sales Opportunities



OR *YOUR* PRODUCTS . . . IN PLASTICS

The success of this flashlight, with case, button, and lens of cellulose acetate, throws light on the remarkable *combination* of sales, design, and manufacturing advantages which cellulose acetate plastic offers to the product *you* make.

OW COST. Cellulose acetate makes pos-e speedy automatic molding—by the mil-s. And metal parts can be inserted before ding. You save time, labor, and finishing.

EMARKABLE STRENGTH. The tough lience of cellulose acetate plastics opens un-ted design possibilities. It is non-flammable lightweight . . . pleasing to the touch.

BEAUTY THAT SELLS. Cellulose acetate plastics can have the colorful loveliness of a flower garden, or the translucent charm of precious jewels, or the sparkle of crystal. The lustrous colors cannot wear off, or tarnish.

YOUR PRODUCT can profit from this top combination of advantages. But to get the latest development in a cellulose formulation to fit *your* product—with the uniformity and purity made possible by the research and production skill of the world's leading producer of cellulose derivatives—specify *Hercules Cellulose Acetate flake.*

For a booklet on Hercules Cellulose Acetate, write Department **MP-9.**

DDD-86

*

HERCULES

CELLULOSE ACETATE

*

ERCULES POWDER COMPANY · WILMINGTON, DELAWARE
Incorporated

8 W-S INJECTION MACHINES *Serve Consolidated Plastic Customers*

Top performance by the first three machines installed by Consolidated Molding Products Company is responsible for the reordering of five more of these efficient W-S precision automatic injection molding machines.

During the time W-S machines have been in active service under gruelling high-speed production conditions they have proved their ability to reduce the cost of plastic production by unusual speed and dependability in the manufacture of many types of molded parts. This is but one of several types of W-S Molding Machines engineered to meet today's requirements in plastic moldings.

ALL THIS IN W-S *and more!*

These great performance advantages enable W-S Plastic Injection Molding Machines to set new standards in adaptability, quality and lowered costs.

1 *Control*—to eliminate burned materials and permit rapid color change. The W-S Zone Control Heating Cylinder unit—independent multiple heating element makes possible a new precision in temperature control. No need to waste costly materials.

2 *Positive Clamp*—easily adjustable over large areas, eliminates flash. Secure clamping of molds without transmitting strain to other parts is essential to accurate molding. You get it with W-S Positive Clamping mechanism, actuated by an adjustable stroke hydraulic cylinder, even with the highest injection pressures.

3 *Capacities*—W-S presses are available in 6, 8, 12, and 16 oz. capacities—one for every need. Write for further information.

To mold with greater accuracy do as Consolidated did—install W-S Injection Molding Machines. Illustration above shows a section of this modern Consolidated Molding Products Company plant with W-S Injection Molding Machines in action.

Use WATSON-STILLMAN *for Molding*

THE WATSON-STILLMAN CO. • ROSELLE, N.J.

This is for the Future

Advertising is a problem these days. We are very close to the saturation point of our equipment and non-defense material is hard to get. Our salesmen have been called in to the factory as internal expediters.

Why advertise? Why keep the flag waving?

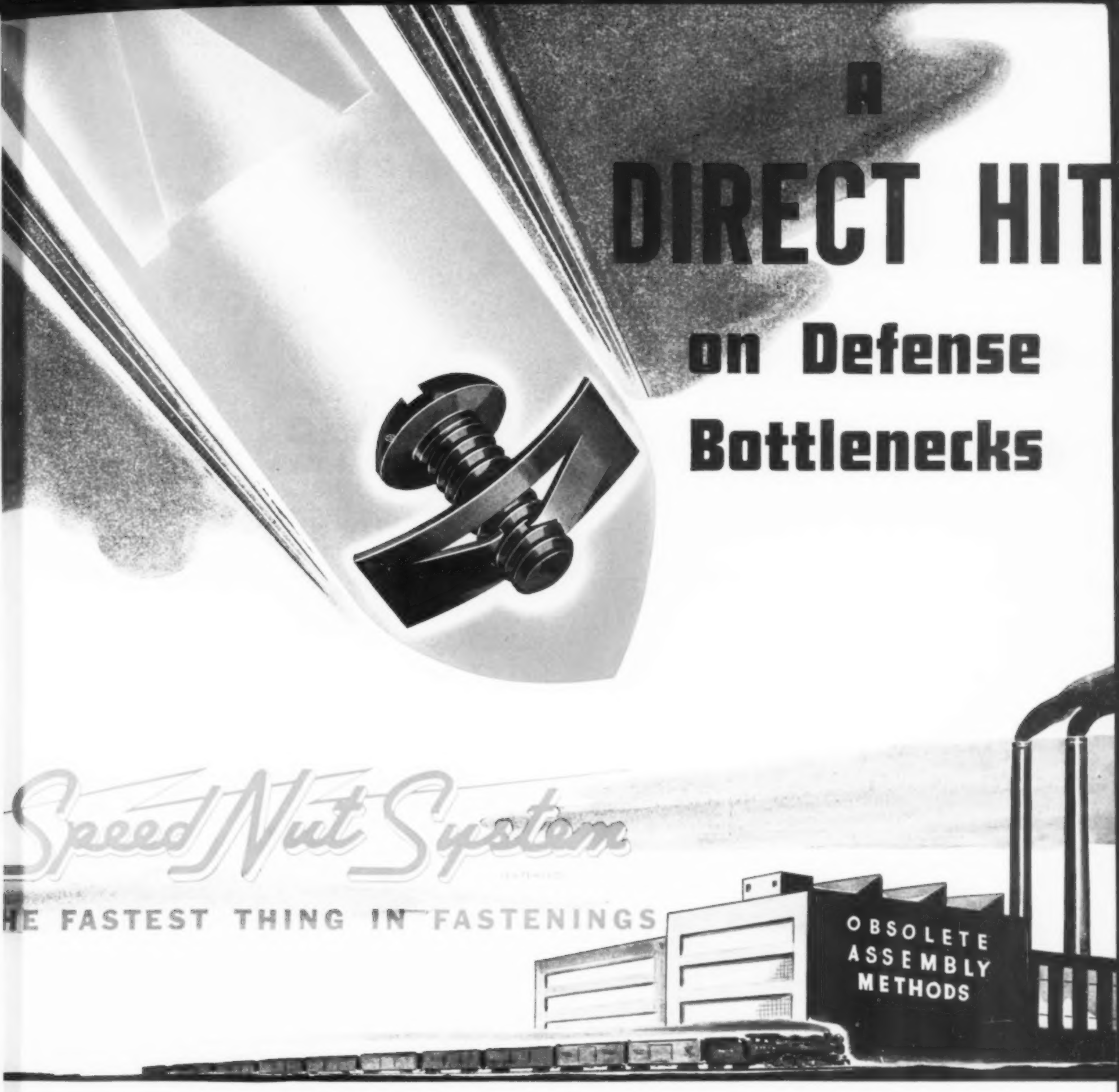
Conditions will not always be like this. Sometime the boys will be back ringing doorbells and saying "Please sir, could I see you for a minute." To-day the purchasing agents serve cocktails to any salesmen that will call—to-morrow the salesmen will again bring their own including ice, and it had better be good.

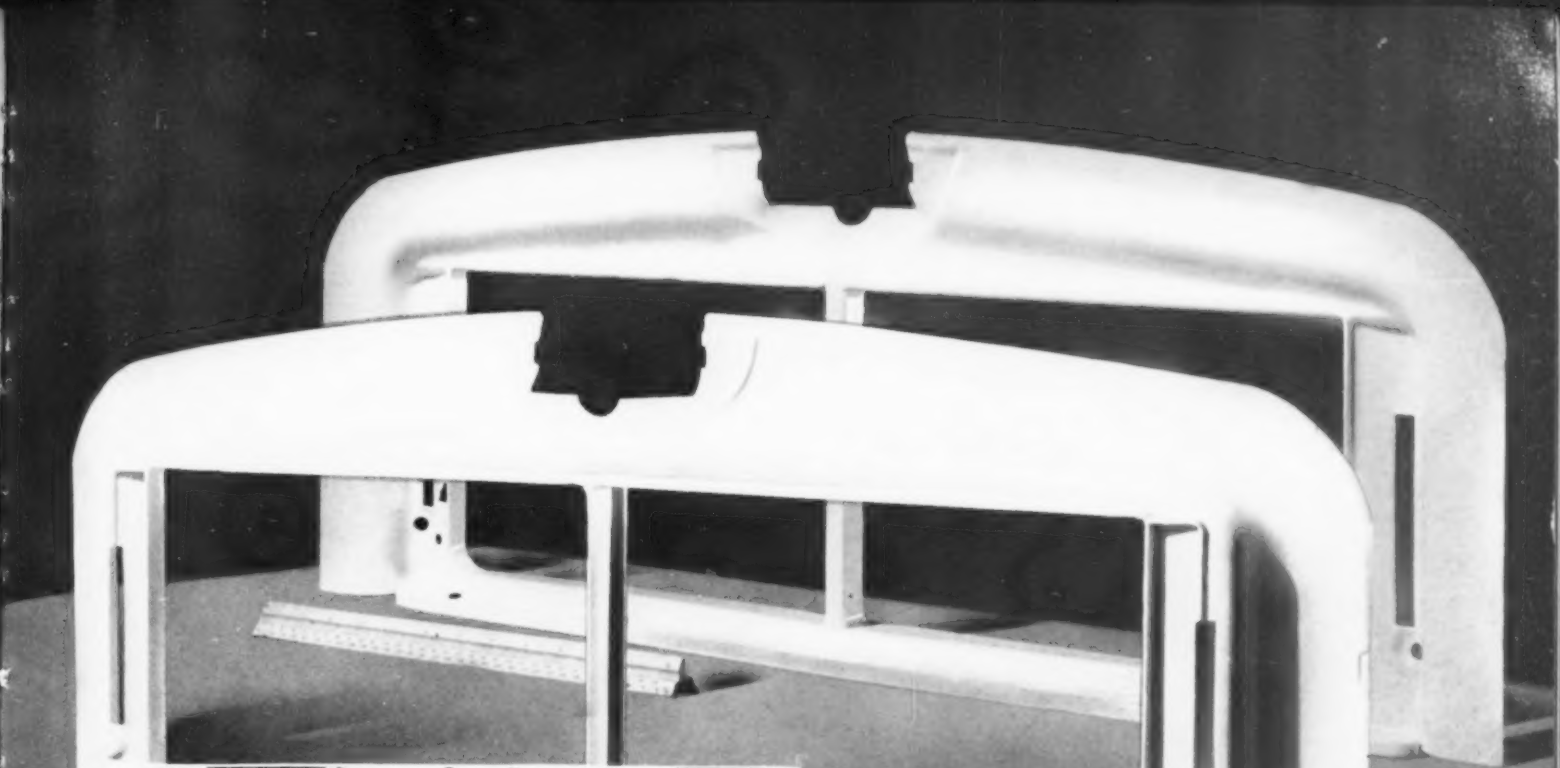
Doing business under these conditions is a queer mixture of satisfaction because the factory is up to production and fear that some one will be offended.

We must advertise—not for to-day or to-morrow, but for next year.

We're advertising to help you remember our name and the fact that we'll still be wanting your business—providing its new business—in 194? or whenever normalcy returns. Right now, like so many businesses and individuals, we're dedicating our production to defense, and our advertising to the future.

BOONTON MOLDING COMPANY
MOLDERS OF PLASTICS · PHENOLICS · UREAS · THERMO-PLASTICS
BOONTON · NEW JERSEY · Tel. Boonton 8-0991
N. Y. Office—Chanin Bldg., 122 East 42nd Street, Murray Hill 6-8540


A
DIRECT HIT
on Defense
Bottlenecks
Speed Nut System
HE FASTEST THING IN FASTENINGS
OBSOLETE
ASSEMBLY
METHODS



Die set-up showing separate injection nozzles

Front and back of Philco Refrigerator panel size 28-1/4" by 9-3/8" by 2" . . finished weight 13 ounces.

Only the H·P·M MULTIPLE UNIT PRESS *can produce injected plastic parts of this size and weight*

One of a battery of H-P-M Injection Molding Presses, each having a 500 ton clamp pressure and capable of injecting 36 ounces of plastic per cycle. Each press is equipped with 4 separate injection units.

THE HYDRAULIC PRESS MFG. COMPANY

Mount Gilead, Ohio, U. S. A.

District Sales Offices: New York, Syracuse, Detroit and Chicago

Representatives in Principal Cities

WITH Beetle THE PLASTIC THAT'S ALL COLOR . . . IN ALL COLORS

Ariston, Inc., beauty parlor supply specialists, produced this handsome, simplified and more efficient dispenser housing for wave set solutions. Designed by Howard C. Mitchell, it is an outstanding example of fine appearance, unusual utility and economy that can be achieved with molded BEETLE*.

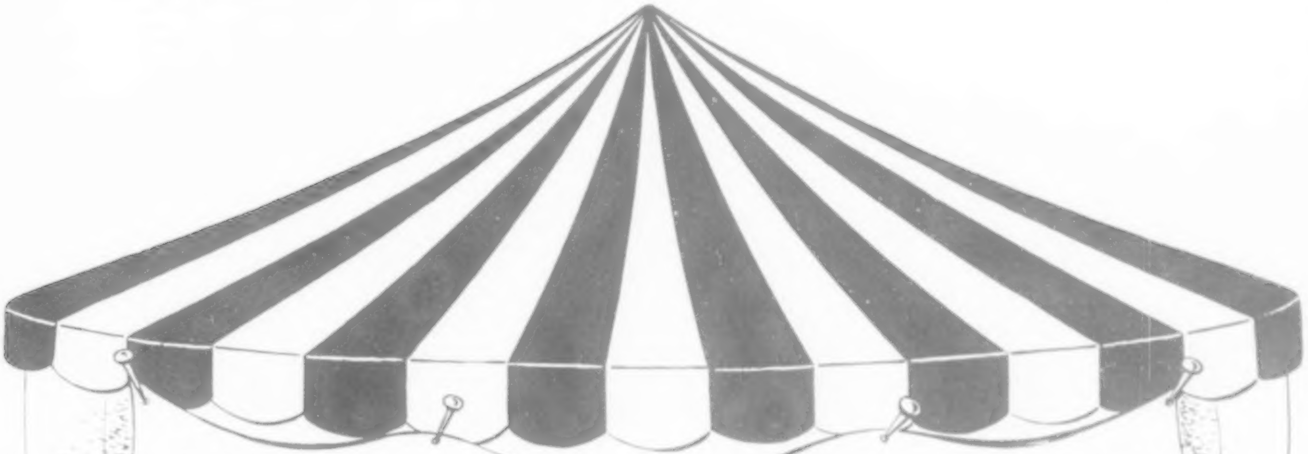
When planning new product and product housing designs, to obtain the best in results with plastics, consult with a reputable molder. His experience and knowledge of plastic molding materials and methods are invaluable to the achievement of highly satisfactory results at comparatively low costs.

AMERICAN CYANAMID COMPANY
PLASTICS DIVISION
30 ROCKEFELLER PLAZA • NEW YORK, N. Y.

*Trademark of American Cyanamid Company applied to urea products manufactured by it.

Modern Plastics
WILLIAM T. CRUSE, Editor

SEPTEMBER 1941 VOLUME 19 NUMBER 1



DUMBO at the CIRCUS

Transparent cellulosic sheets in carload quantities yearly are the foundation of the gigantic animated cartoon industry

MILLIONS of Disney devotees would be deprived of the sight of Dumbo, the flying elephant, if it were not for cellulose sheets. It is the plastics industry that has brought the breath of life to such brain children as *Dumbo of the Circus*, Disney's picture; *Fantasia*, *Snow White*, *Pinocchio* and the whole lovable galaxy.

Plastics have always had a hand in motion pictures. They started their career in the educational and amusement field during the adolescent period of their growth when they were first used in making motion picture film. A long technical road has been traveled from the early days of the "flickers" to sound movies, color films, animated pictures and to the perfection of an interpretive production like *Fantasia*. As early as 1890 a machine was perfected for continuous celluloid film and out of continuous film grew the motion picture industry. In 1910 the first cellulose acetate safety film was used, and it is on this material, sometimes with the addition of nitrate, that the Disney pictures are printed.

Forerunner of Disney was one Joseph Antoine Plateau who, in 1826, fashioned a toy called "Phenakistoscope." This gadget gave "animated" movies through a series of drawings. These were viewed through two disks mounted on a shaft. The front disk had a series of slits around its outer edge. In peering through slits of the front disk as it revolved an impression of motion was created. Drawings themselves were held by a rear

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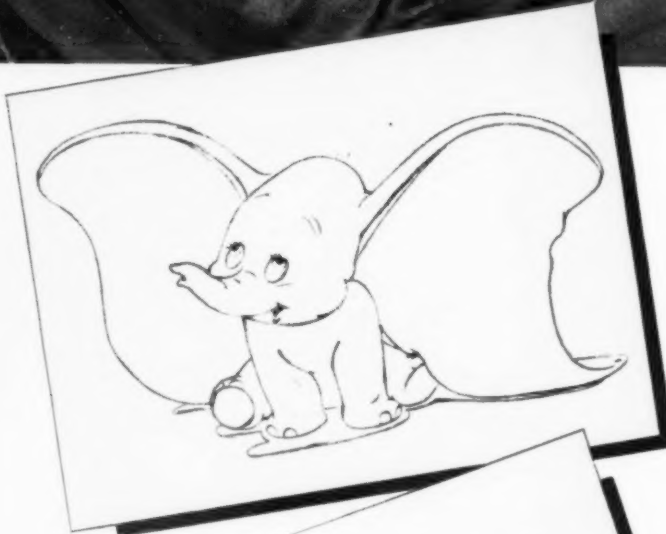

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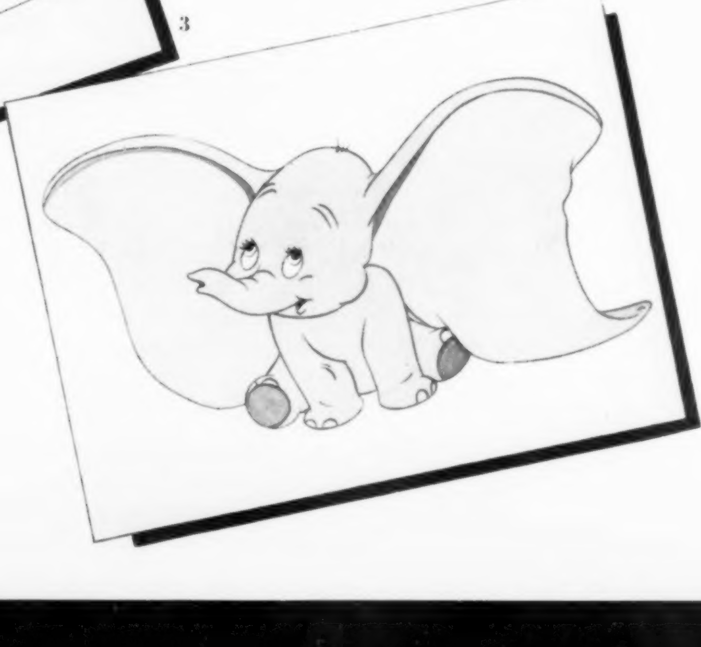
disk. Other attempts to perfect cartoons followed, but the most successful appeared in 1906 under the droll title: *Humorous Phases of Funny Faces* produced by Vitagraph. It took the sinking of the *Lusitania* to bring on the next "animated" film in 1918 when Winsor McCay drew its horrors for a feature length dramatic cartoon used as a propaganda picture for World War No. 1.

Mickey Mouse, created by Walt Disney, was the first cartoon of the sound era in motion pictures. He made his bow at the Colony Theater, New York, in *Steamboat Willie* and soon captured the hearts of the most discriminating audience in the country. Today he is an established figure in the motion picture industry A steady stream of new pictures have come from Hollywood since Mickey, and today *Dumbo of the Circus* is eagerly awaited by all Disney fans.

An idea of the part plastics plays in Disney produc-



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tions may be gained when one looks at the figures. The quantity of cellulosic sheets used for one year was 800,085, or 108,135,568 sq. in. As soon as the sheets arrive they are sent to an icy cold, humidified fireproof vault. As the current stock is depleted they are brought in bundles from the vault, cut into different sizes required. The perfect plastic film measures $^1/_{5000}$ in. thick. A slight variance of thickness, or a flaw in the film, shows up on the camera immediately.

The animated drawings are traced in ink onto the transparent sheets. Then they are colored on the reverse side. Once painted, they are sent to the camera department and photographed over appropriate background. The painted plastic sheets are held by the department until there are no more "retakes" on the particular scene in production. Each drawing is carefully inspected at this point to select those that can be mounted and made available to the public through art stores and galleries. There are very few of these because most of the drawings are, of course, extreme poses for action. In a series, these action pictures form a consecutive motion picture film. After the best cellulosic sheets have been selected, the remainder go back to the "cel" washrooms where they are immersed in a solution of water and sodium sulphate mixture which removes ink and paint. They are used as "spacers,"

1—William Peed, story sketch artist, at work on the little circus elephant who is the star of Disney's *Dumbo of the Circus.* Drawing board and wall are covered with hundreds of elephant pictures clipped from magazines for inspiration and study. He holds a model in his hand made by the studio. 2—Pen and ink sketch of Dumbo. 3—Outline of the animal is transferred to cellulosic sheet. 4—The next stage in which our coy friend is painted on the reverse side of the cellulosic sheet. 5—Still of the film in full, brilliant color showing Mother and Son. Mrs. Jumbo is giving her baby as much attention as a parent can at a big circus where she is an active member of the troupe. Mrs. Jumbo, and this is straight from Hollywood, got Dumbo from a special delivery stork who got lost in a storm and missed the circus at Florida. He caught up with "Casey, Jr.," the circus train, and delivered Dumbo to his awaiting parent. Dumbo is distinguished by his over-size ears which eventually bring him fame and fortune when he learns to use them for flying

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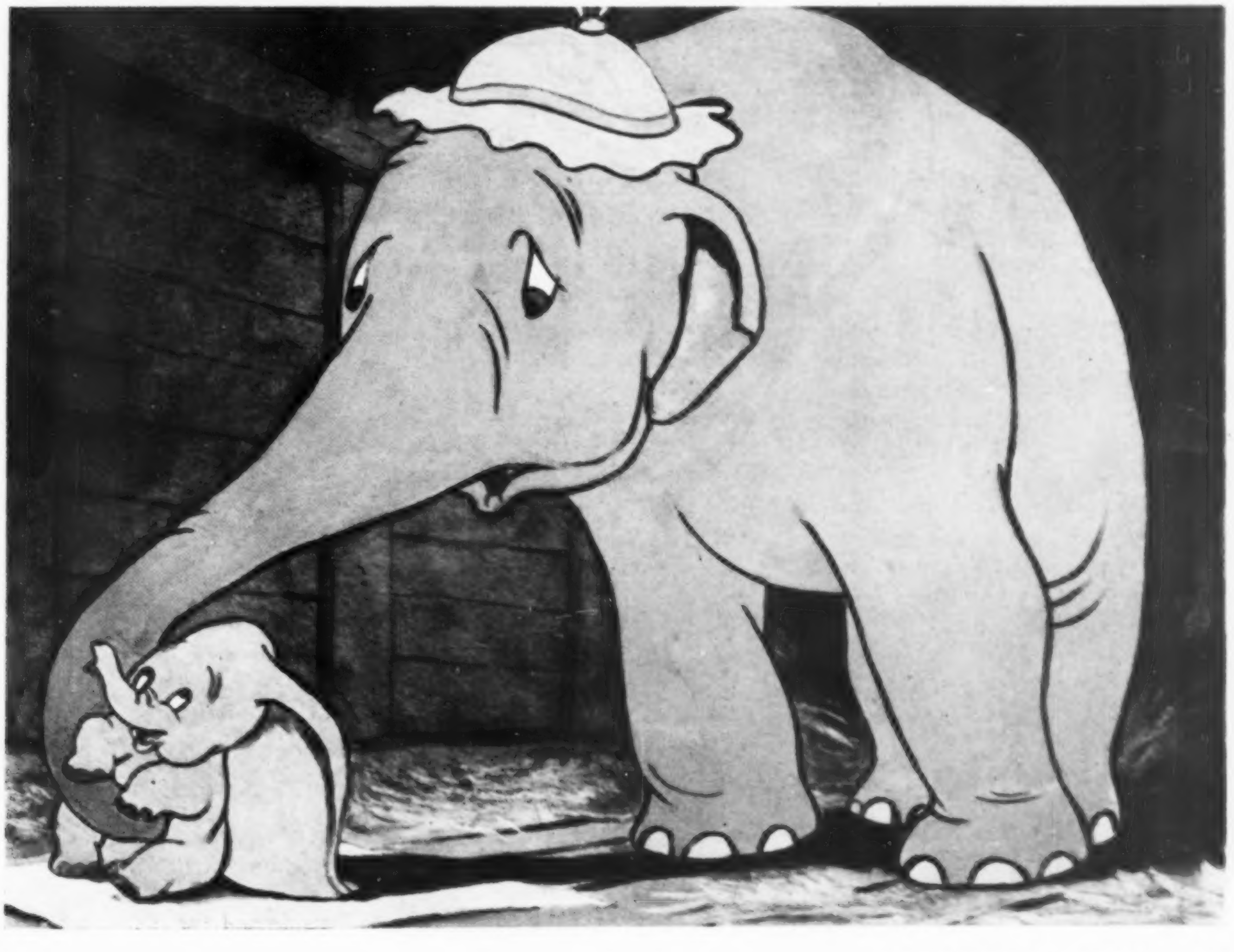
COLOR PLATES, COURTESY CELLULOID CORP.



COLOR PLATES, COURTESY CELLULOID CORP.

6

6—Mr. and Mrs. Tiger of the Big Tent are expressing gratification over their new offspring just arrived via parachute. The Disney story has it that the stork drops all babies in parachutes to all good animals in the circus come Spring-time

slipped in between new plastic sheets to protect them.

Making either a short or feature length cartoon involves essentially the same procedure. The short productions, however, do not require such long scripts. Instead, the brief plot is laid out in a series of colored pencil action sketches pinned in sequence on a huge board. When the story is worked out satisfactorily, the board is moved from rooms of the story crew to those of the director assigned to the picture. After changes are made and approved, the picture swings into action with the musicians, layout men, background artists and animators working on their individual projects. Many meetings are held until the story has become a part of the very life of those involved. The animators, those who draw the pictures or sketches, do not begin to draw a sequence of action until the background layouts are finished and the dialogue, sound effects and music have been recorded. The animator must watch the scene carefully so that his characters do not walk through trees and other insurmountable objects.

After the dialogue is recorded, it is turned over to the cutting department where it is analyzed and charted in terms of single frames and length of each word. Care is even exercised in measuring the intervals of inhalations and exhalations of characters. If Dumbo says, "Hello," for instance, the cutting department indicates that his word recorded takes 8 frames of film. The animator must then produce 8 drawings in sequence in which the lips move to form the word plus whatever bodily accent or motions may have been decided. Actual sound effects are similarly charted.

Literally hundreds of artists work out and develop the action. The more experienced animators plan the general course, while assistants do the finely graded changes required to complete the action.

The work is done on illuminated drawing boards so that after one sketch is completed, a second piece of semi-transparent paper can be placed on top of it and a new drawing made which varies just enough to make the motions and smiles of the character look natural. After a series of drawings are made, they are photographed and run through a projection machine.

Animators can then study the smoothness of action and similarity to real and living creatures.

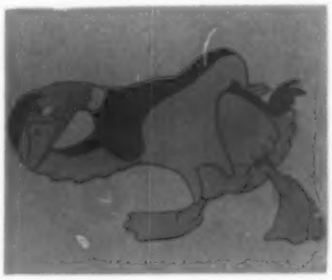
The artist or animator who interprets the action sometimes creates new performers in working out the script. These sketches are usually rough conceptions. As soon as drawings are approved, they are sent to the inking and painting departments where they are transferred by skilled girls to cellulose sheets. These standard sizes of 10 by 12 in., and $12^1/_2$ by $15^1/_2$ in. are called "cels." The characters are skillfully outlined so that they lose none of the charm of the original sketch. Black ink is used on only one side. The outline drawings are then transferred to the artists who do the final coloring. All color is applied on the reverse or back side of the transparent "cel." Since the sheets are transparent it is simple to follow the ink lines of the drawing. The colors which are to be used are selected and designated by laboratory test.

Although the problem appears to be simple, painting on plastic with water color paints is a difficult task. Formulations of special color and consistency are carefully ground and prepared for the artists and the best paints are used to produce naturalness, beauty and action. Paints are applied with brush or pen, but unless they are exactly right they will recede from the boundaries established in the original tracing. This, of course, is due to the smoothness of the plastic and the high surface tension of the water-color paint.

The methods of making backgrounds is much the same as the character action drawings. When more than one background is used, it is superimposed on the other. They are moved following each photograph taken of them in a series giving the effect of motion in the film. After the inking and coloring have been finished the work of the art department is theoretically complete. The "cels" are then ready for photographing. Each "cel" is placed over the correct background and shots taken of them.

Two standard types of Disney-made cameras are used—a regular crane camera for shorts and for repeating standard scenes and a multiplane camera for depth and atmosphere shots. All of the Nutcracker Suite scenes in *Fantasia* were photographed on multiplane equipment with excellent result.

"Cels" can be photographed to produce approximately 15 ft. of film per hour. It usually requires about 2 weeks to photograph the average 7-foot short production. It takes approximately 45,000 drawings to make one 700-foot reel of film. There is an average of 4 drawings to plastic "set-up" which, when photographed, constitutes one frame of film. There are 16 frames of film to a foot. The film will run through the projector at the rate of 90 ft. per minute. After a production is filmed, the processes leading up to the finished product are like those in the regular motion picture studio. Sequences are strung together and previewed for audience reaction, edited and eventually released.



Step by cautious artistic step animated and

7—Milt Neil, who seems to be making funny faces at himself in the mirror, is doing just that. Animators work with a mirror over their drawing board so that they may transfer human likenesses to animals who will cavort through the film. He will make workable sketches from drawings. 8—Claude Coates, background artist, paints a water color background

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serious cartoons are produced in this manner. While methods are being improved, while refinements in practice are being made, with the exception of the gradual change from nitrocellulose to cellulose acetate, plastics remain solidly in the background of animated movie success today.

Original plans called for Dumbo as a short production, but all of those who had any connection with the picture were unanimous over the possibilities of creating a full-length feature around the engaging little elephant with the big ears. From January 1940 until June, story men were developing the Dumbo idea into a feature.

In this colorful circus story, Disney and his artists had ample opportunity for developing the types of characters they like to do best: pathetic, lovable, ugly-duckling little Dumbo himself; the addle-pated stork who brings him; raucous little Timothy, the circus mouse who befriends him; His gentle mother—Mrs. Jumbo; the formidable foursome of the circus elephant social strata—the Matriarch, Giggles, Prissy and Catty; the pompous bellowing ringmaster; the dizzy clowns; the humorous raggle-taggle crows who teach Dumbo to use his ears for wings, and thus help catapult the little fellow to world fame; and all of the other animal characters without which no circus menagerie is complete.

Some of the human actors chosen to lend their voices to this band of new Disney characters have been heard before. Cliff Edwards, for example, returned to the lot to do the voice of one of the crows. He will be remembered as the voice of Jiminy Cricket in *Pinocchio.* Film star Herman Bing did the ringmaster, while the commanding voice of the old bossy matriarch of the circus elephants was done by Verna Felton, better known to radio audiences for her characterization of Dennis Day's overbearing mother on the Jack Benny program. Sterling Holloway furnished the voice and much of the personality for the comedy character of the stork. Another radio personality, Eddie Holden, the creator of the character of Frank Watanabe on the air, took the part of a clown. The personality and character of Dumbo himself has been created entirely in pantomine, with garrulous Timothy Mouse, Edward Brophy, acting as mouthpiece.

Dumbo captures the glamor and color of the Big Top so completely that it would be easy to believe that every artist and musician responsible for the RKO Radio release spent his life under canvas. Actually, the boys and girls did spend several days behind circus scenes, and it's hard to say who had a better time, the performers or artists. Whenever a circus came to Hollywood or vicinity, artists were at the railroad tracks at four o'clock in the morning to watch the unloading.

The sketches completed "on location" would fill a library, and the fun they had shines right in the film.

Credits: Material by Celluloid Corp., Monsanto Chemical Co., Tennessee Eastman Corporation.

11

9—Eve Gerstad, an inking and painting supervisor, checks over the animation drawings at the Disney studio before handing them out to over 300 girl-artists who trace and paint on cellulose sheets. 10—Emma Torrey is busily tracing an animation drawing of Jim Crow from "Dumbo at the Circus" on cellulosic sheet. Over 500,000 of these are used in an average full-length production. 11—After the plastic sheet has been inked (the outline of the animator's drawing traced), color is applied to the reverse side. Over 1500 different colors are used in the studio, each one a different and secret formula. Artist is Phyllis Bounds

Ford builds a plastic auto body

WITH characteristic hominess, Henry Ford presented his plastic motor car body, which industry had been eagerly awaiting, first to his own townspeople at Dearborn, Mich., at a "Dearborn Day" celebration last month.

The official presentation of the car confirmed long standing rumors that company research engineers had been working on this problem. Though the car makes its appearance when a steel shortage threatens to cripple the automobile industry's non-defense production, Ford officials point out that the plastic automobile body is still in the experimental stage and that substitution for the conventional steel body is still a long way off. But the new body is no "ersatz" substitution. It climaxes a dozen years of research based on Ford's long-standing belief that some day he would "grow automobiles from the soil."

The car Dearborn citizens saw is only the forerunner of Unit 2, now under construction. It was designed to take advantage of the peculiar properties of plastics, but in appearance it is not radically different from the conventional steel models. Robert A. Boyer, who has worked on the problem since its inception, is already busy correcting and changing defects and limitations of the first model.

Although possibilities of a plastic body were explored in Germany, the Ford conception of the problem is entirely different and original. A few cars were produced with molded phenolic fenders, rear decks and body panels, but full scale commercial production was never undertaken abroad. The method employed was a standard procedure with regular grades of phenol-formaldehyde molding material using huge compression presses which were especially constructed to preform the molding. In the production of the Ford plastic car, the framework of the regular model was entirely redesigned and lines substantially altered. The type of plastic material and the process for molding it have been revolutionized at the Ford laboratories.

"Our work was started on the plastic car last December," said Mr. Boyer. "We decided to design the car from the ground up and to style it especially for plastics. For instance, many deep draws were eliminated. This explains the absence of the conventional fenders on the completed car. A welded tubular framework was designed to allow the fastening of plastic panels without putting any strain or load on the plastic. All loads with the exception of course of impact loads are taken by the welded tubular frame. This construction of a frame is much stronger than the orthodox type and in the event of a car rolling over offers more protection than standard construction. The plastic has been fastened to this frame by means of clamps and screws. The joints have been sealed over with a self-hardening plastic compound which conceals the joints very well.

The plastic panels were preformed by a felting opera-

1—It's a long trek from the "Model T" to a car body with plastic panels, but it has finally been accomplished by Mr. Ford Below is a welded tubular frame, which is much stronger than most. The plastic will be fastened to this frame by means of clamps and screws. 2—On the opposite page is R. A. Boyer of the Research department, and Mr. Ford with the car

tion on vacuum molds which were the same contour as the finished piece. Improvements in our technique allowed us to use less molding pressure than is usual in some cases amounting to only 50 lbs. per square in. This gives a material of less density than the usual molded plastic but still retains good rigidity and strength characteristics.

Design was among the first considerations. Heretofore engineers in considering molding structural automobile parts had thought in terms of molding long fenders with deep draws, of producing cowl parts with big areas and sharp curves and of making other body parts with equally complex surfaces. This time, however, engineers closed their eyes to the metal cars rolling off the assembly lines and took the properties and the working qualities of the material they were going to use into account.

The result was that they discarded parallel I beam frames, or variations of them, which is the foundation upon which most cars have been built. Engineers developed instead a tubular frame with longitudinal supporting members overhead as well as similar longitudinal supports below the car floor to support the body, engine and other parts of assembly. A feature of this frame is its light weight of less than 250 lbs. Reduction of weight was also one of the major objectives, allowing the use of a smaller motor as well as lighter running gear parts. Actually, the first car represents a weight reduction of about 30 percent over a standard production model of the same body type.

With this framework it was practical to redesign the 14 surface panels which make up the body. The molding method is a marked departure from the standard compression technique. The molding process is divided into three main stages: preparation of molding, composition, preforming and molding.

Instead of using powder or granulations to preform and mold a resinous pulp, fiber composition is employed. Phenolic resin is added to wood fibers in a pulp state. The combination is thoroughly agitated to insure complete mixing while all fibers are in suspension. Other types of fibers such as flax, raimi or hemp may be introduced at this point to provide strength as needed.

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While the resinous pulp is still in solution it is preformed by lifting it from the solution. This is done by using a vacuum introduced through a formed heavy gage screen held in position by a steel back plate.

When the vacuum is shut off the preform is released; most of the water has been sucked off. The preform is then pressed and dried after which it is ready to be molded. Before molding the preform is about $3^1/_2$ to 4 times as thick as the finished molding. They are molded in steam-heated hydraulic presses. Improvements in the molding technique have allowed molding with pressures, in some cases, amounting to only 50 lbs. per sq. in. While this produces a material of less density than usual, good rigidity and strength characteristics are retained.

In contemplating production, in order to offset the greater time of a plastic molding cycle as against the time of stamping metal shapes, a tier arrangement of molds is possible. By placing several molds in one press, one above the other, an operator's production would be increased proportionately. High frequency current affords a possible source of a rapid molding cycle. Installation for this is now being made at a West Coast plywood plant and reports are encouraging regarding its performance. Ford has also experimented with using this type of energy.

The first Ford plastic car has been painted to obtain a high color. In production certain color could be incorporated in the molding composition.

Thus far no effort has been made to use the natural color of the molded plastic as the finish for panels. There are color limitations in all phenolic materials, of course, and it was evidently thought best to paint color on for the first car. What may materialize in the way of color in future cars is a matter of speculation at this point.

The only steel found in the entire superstructure of the body is in the tubular welded frame on which are mounted 14 plastic panels that make up the unit. The total weight of all the units (*Please turn to page 78*)

5

3—Here is an interesting Laboratory scene in which an engineer is preparing the fibers and resins. Phenolic resin is added to the wood fibers in a pulp state and the combination is thoroughly agitated to insure complete mixing while all the fibers are in suspension. 4—While the resinous pulp is still in solution it is preformed by lifting it from the solution with a vacuum. This is done by using a vacuum introduced through a formed heavy gage screen held in position by a steel plate. 5—When the vacuum is shut off, the preform is released

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1—Revolutionary advances in manufacturing and performance of precision high speed abrasives have been made possible by use of synthetic resins as a bonding medium. Steel mold shown in the press contains abrasive and bond mix prior to forming by compression and heat. 2—These resinoid-bonded wheels are efficient for high speed snagging and billet grinding

Resinoid bonded grinding wheels

by E. T. LARSON*

OUR country's vast defense effort today is primarily an industrial one. Guns, planes, tanks, warships—all products of the nation's factories and shipyards—are the instruments of war upon which the citizen's attention is focused. Behind all of these weapons, each a marvel of mechanical precision, are the less publicized but tremendously vital raw materials, machine tools and cutting tools that produce them. Numbered among the variety of cutting tools is the all-important grinding wheel.

The reader may be surprised to know that in contrast to the crude emery wheel of a few years ago, abrasive wheels today are manufactured with a precision comparable to that which they impart to the crankshaft, cylinder bore, or other parts they are called upon to grind. Among the several different types of abrasive wheels in common use today is the high-speed resinoid bonded wheel, introduced not much more than a decade ago and hailed as one of the most important strides in the abrasive industry.

The essential ingredients of resinoid grinding wheels are the abrasive grains that do the cutting, the resinoid bonding agent and a chemical plasticizer which is usually furfural. These are thoroughly mixed together in proper proportions and an amount sufficient to make one wheel is weighed out and distributed in a steel mold, which is then compressed to form a wheel of required thickness. Next, the wheel is baked in an electric oven under carefully controlled temperature conditions. The heat first melts the resinoid bond causing it to flow in and around the individual abrasive particles. With additional heat the bond hardens and becomes strong and these properties are retained permanently after the wheel has cooled. Finally the wheel is trued to finished size and shape, graded, balanced, speed tested and inspected. The grade or hardness of the wheel is controlled largely by varying the properties of resinoid bond to abrasive.

A grinding wheel cuts, that is, removes material in the form of minute chips, by reason of thousands of tiny abrasive particles on the grinding surface—each a separate miniature cutting tool—doing its work at a rotative speed of several thousand feet a minute.

The speed of rotation sets up a centrifugal force tending to rupture the wheel. The maximum safe operating speed of any wheel is governed largely by the strength of the bonding agent. Early grinding wheels produced by man consisted of natural abrasives like emery and corundum, and later manufactured aluminous and silicon carbide abrasives, all vitrified or clay bonded. These wheels are burned at a temperature high enough to fuse or vitrify the clay into a molten glass condition. Majority of *precision* grinding wheels in use today are of this same vitrified bonded type.

Vitrified wheels are generally limited in their operating speed to 6500 surface feet per minute. To a large extent the rate at which a grinding wheel cuts or re-

* Norton Co. Sales Engineering Department.

moves material is in direct proportion to its peripheral speed. If, then, it were possible to operate a grinding wheel at 9000 or 9500 s.f.p.m. (an increase of 45 per cent over 6500 s.f.p.m.) a marked increase in rate of material removed or production could be expected.

Just such a high-speed wheel was made available to industry during the 1920's, a most opportune time. This was the era of tremendous expansion of the automobile industry with its urgent demand for speed and production, and constant search for the best possible way of doing things.

The secret of this new high-speed grinding wheel was an entirely new and stronger type of bond—synthetic resin or resinoids. The ground work for the development of resinoids as a bond for abrasive wheels was laid as far back as 1907. Years of laboratory experimentation followed before satisfactory materials and processing for making the resinoid bonded grinding wheels were perfected. Several of the abrasive wheel manufacturers cooperated closely in this development and contributed in no small measure towards its success.

The early resinoid bonded wheels were all of dense structure and, as such, cannot be said to have been very efficient. As made today, they have open or porous structures, resembling vitrified wheels in this respect. These improved resinoid bonded wheels were brought forth around 1925. Sixteen years later finds the abrasive wheel manufacturers engaged in extensive research to still further improve their cutting and wear resisting qualities.

Resinoid bonded grinding wheels can be made to any practical size and shape, any grain size and in almost any grade of hardness that it is possible to produce by the vitrified process.

The extensive research and experimentation of the abrasive wheel manufacturers in adapting resinoid bonded wheels to various fields of grinding would make an interesting story in itself. Within the limited scope of this article, however, we can only touch upon some of their more important applications.

One of the largest uses of resinoid bonded wheels is for snagging or rough grinding castings. The streams of sparks spurting from high-speed swing frame grinders, floor stands, disk grinders and portable grinders in the cleaning room of a typical modern foundry testify to the effectiveness of resinoid bonded wheels operating at a speed of 9500 s.f.p.m. in cutting through scale, gates and risers.

In the steel mills, one of the important operations is to remove flaws and seams from billets before they are rolled into sheets and structural shapes. On certain types of high-grade steels, this is being done almost exclusively by means of high-speed swing frame grinders and portable grinders equipped with fast-cutting resinoid bonded wheels.

Thin resinoid bonded abrasive wheels, strong enough to be safely operated at 16,000 s.f.p.m.—a speed of more than three miles a minute—transformed the abrasive wheel method of cutting-off from hardly more than a tool room job into a high-speed production operation. New types of abrasive cut-off machines had to be developed to operate this new type of cut-off wheel at its highest efficiency. As a result, we find resinoid bonded cut-off wheels widely used today for cutting a large variety of materials, including steel brass and aluminum bars of all shapes and hardnesses, ceramics, plastics, insulating materials and even hard cemented carbides.

Portable abrasive saws, some mounting wheels up to 18-in. diameter, are used for cutting brick, terra cotta and other masonry products on the construction site.

In the marble and stone industry, steel center resinoid bonded wheels are employed for coping marble, granite, slate and similar building stone. Cuts up to 6 in. deep with traverse speeds up to 5 ft. per minute are not uncommon. Still larger cir- (*Please turn to page 80*)

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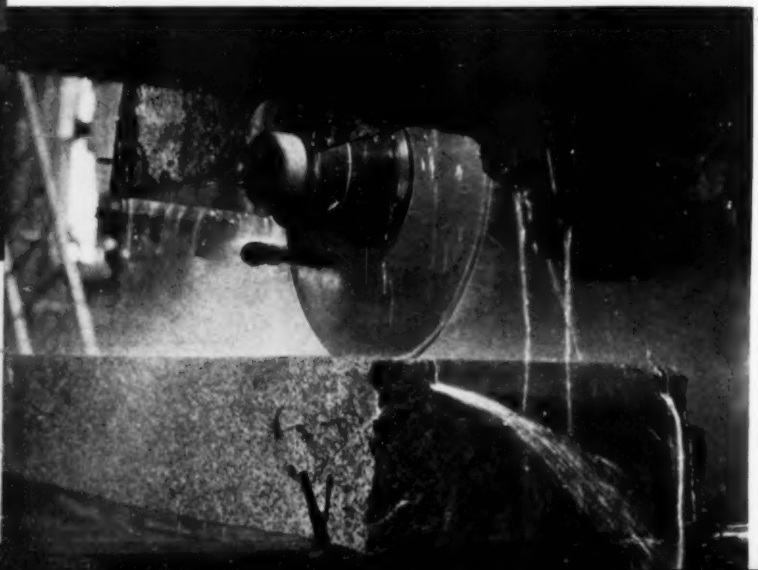

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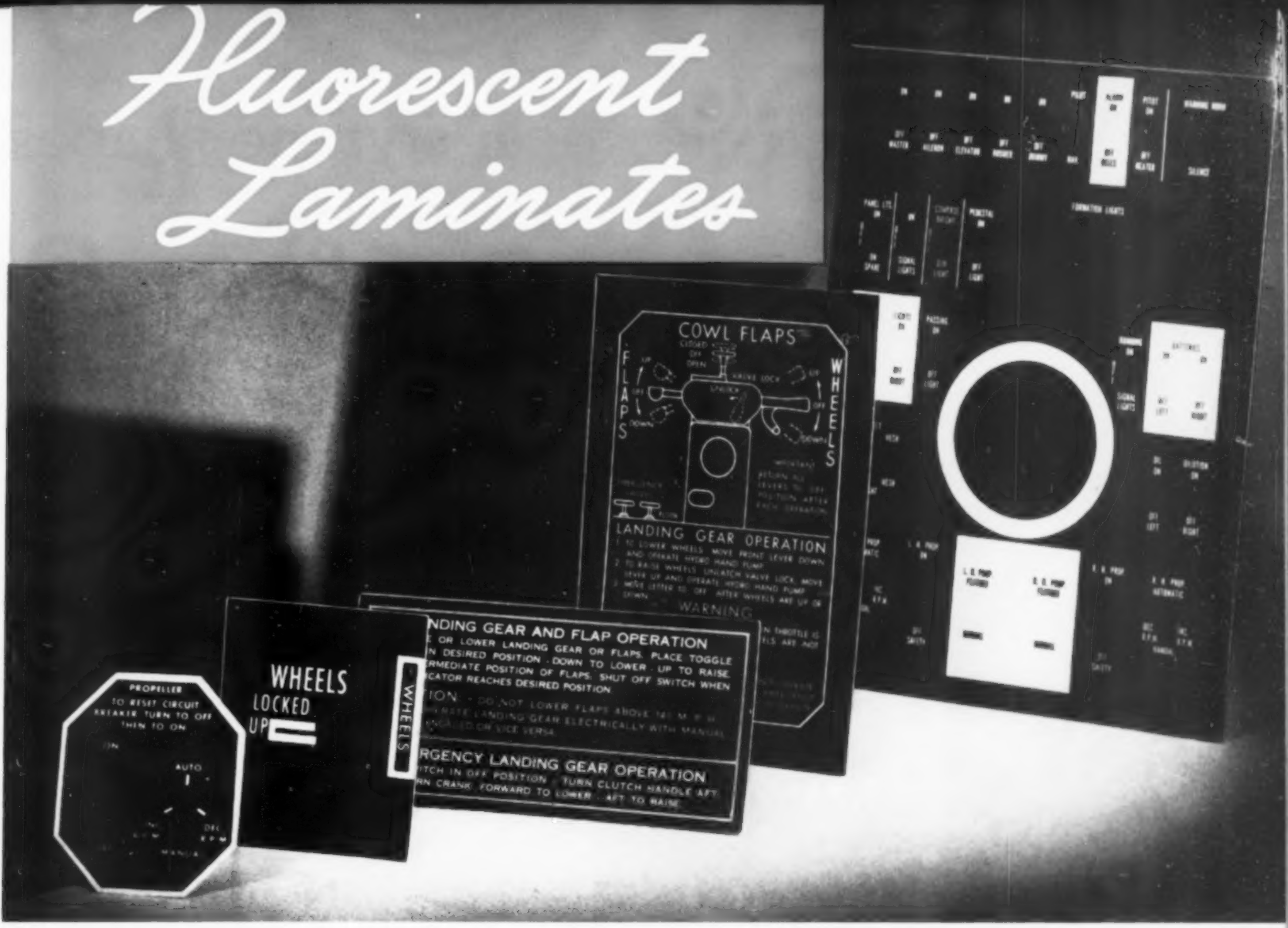
3—This fine grit abrasive wheel is putting a mirror finish on a roll surface. Close tolerances specified are maintained. 4—Granite and other stones are cut and shaped efficiently with resinoid bonded coping wheels

Fluorescent Laminates



by J. F. DREYER*

Machine printed laminates make the difference between daylight and dark for pilots engaged in difficult night flying in Bombers

AID to the night-flying aviator is the installation of fluorescent laminates in bombing and pursuit planes. These fluorescent sheets luminesce when exposed to ultra-violet light, enabling the pilot to read the markings on instruments, switches, name plates and dials in the dark.

Easy to read, these laminates are machine printed so that sharp detail and exact reproduction are possible. The fluorescent substance is incorporated into the sheet below several layers of resistant plastic so the light appears to come from within the dull-finished surface.

The use of fluorescence with black light leaves the cockpit dark, so that it is invisible from the outside. No telltale stray shaft of light can give away the location of the plane. This new method of illumination lights up only the parts to be seen, and only the characters are visible. The larger portion of the cockpit is kept in darkness; hence, the pilot's eyes are kept tuned to the darkness. In fact, the pilots find it possible to adjust the amount of irradiation to about equal that of the starlight outside the plane. This point is important, for it has been found that the eyes rapidly adjust themselves to an increase in light intensity, but slowly adjust themselves to a decrease in light volume. A further advantage of these fluorescent name plates is that the troublesome "ghosts" caused by the reflection of light from the cockpit windows are greatly reduced.

The surface of the fluorescent panel is given an eggshell, non-glossy finish. It can readily be cleaned free of grease or other materials absorbing the ultra-violet light, and because the surface is smooth, there is no possibility of the lettering being scratched off. The panels have the usual chemical resistance, machining quality and the abrasion resistance of the standard product. These advantages are obtainable only in laminated plastic. These name plates are generally supplied from $^{3}/_{64}$ in. to $^{1}/_{8}$ in. thick and are screwed into place. They are placed approximately 25 in. from the energizing ultra-violet source. Several colors can be provided on each panel. Lettering and marking designations, such as lines and arrows, can be used.

The use of fluorescent plastics for blackouts in England foreshadowed the application of laminates. The new step to a laminate is a natural one for decorative laminated inlays in colors and translucent plastic signs have been in vogue for some time. Fluorescent feature required a basically new type of color stimulating material and a new type of illumination. Dyes and pigments previously used for producing the colors of laminates had to be replaced with materials reactive to ultra-violet light stimulus. (*Please turn to page 84*)

* Research Engineer, The Formica Insulation Co.

Industrial and electrical styrene shapes

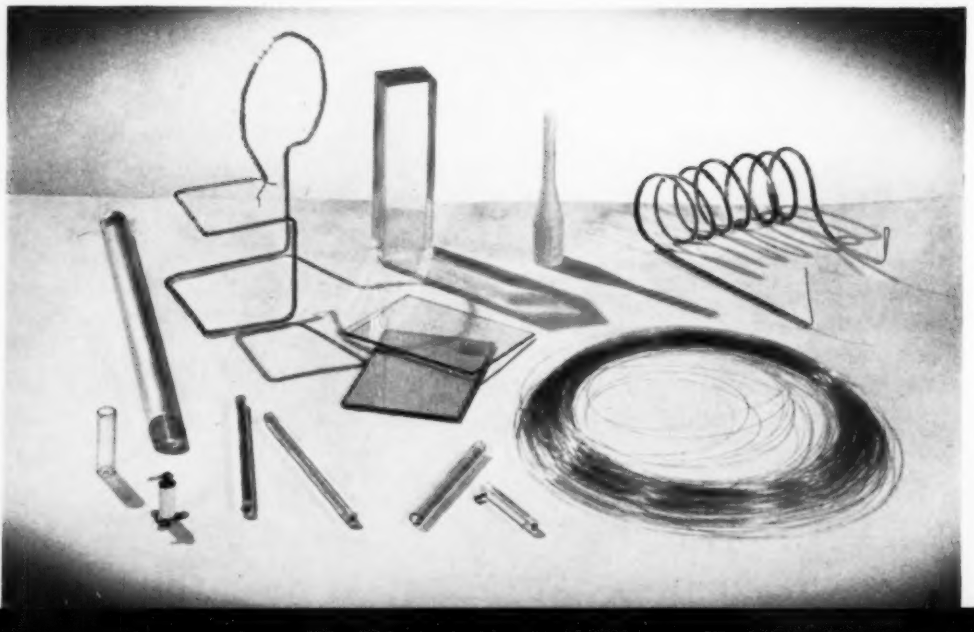
by F. E. WILEY*

RECENT developments, due to extensive laboratory experimentation, have led to new methods of processing polystyrene in special shapes as well as in standard sheets, rods and tubes.

The characteristics of polystyrene are primarily due to the chemical make-up of the material. It is well known that it is a transparent thermoplastic solid in a non-polar structure consisting only of carbon and hydrogen atoms. However, it is because of this chemical constitution that polystyrene is a unique material whose low power factor and low water absorption cannot be approached by any other plastic material. In thin sections it possesses the dielectric strength of an excellent grade of mica and the low dielectric loss of fused quartz. Moreover, there is very little dielectric absorption of polystyrene from zero frequency, even into the range of visible radiation, where the dielectric constant is the square of the index of refraction. These excellent electrical characteristics combined with a water absorption of 0.00 percent and dimensional stability up to 70 deg. C. make polystyrene an outstanding organic dielectric material, as well as a high frequency insulator.

Polystyrene is remarkable for its fluidity under molding conditions as it readily fills the thinnest sections at temperatures and pressures easily obtained on the conventional types of plastic presses and machines. The ability of polystyrene to thus flow under applications of heat and pressure is inherent in the pure resin and is not obtained through the addition of plasticizers as is the case with most other plastics. This fact makes possible the excellent chemical and electrical properties of molded pieces which would otherwise be seriously impaired by the introduction of the usual plasticizers. Commercial polystyrene *(Please turn to page 82)*

* Plax Corp., Hartford, Conn.



Above—Here is an interesting array of polystyrene sheets, rods and tubes. Sheet has found large usage in condensers, insulating layers and protective coverings for high frequency apparatus. Below—polystyrene electrical products including coaxial cable, coaxial beads, insulating fiber, low loss dielectric plates, insulators, spreaders and coil forms. In addition to utilization as coil forms, stand-off insulators, coaxial cable beads and spacers, the material is finding use in the decorating field, particularly in end lighting fixture displays

FEDERAL FORMALDEHYDE PROGRAM

MODERN PLASTICS Magazine presents the three important orders which affect the plastics industry issued by the Office of Price Administration and Civilian Supply and the Office of Production Management.

Part 1—The allocation program covering formaldehyde, para-formaldehyde, hexamethylenetetramine, and synthetic resins produced therefrom.

Part 2—The Office of Production Management Order.

Part 3—Office of Price Administration and Civilian Supply, Price schedule governing formaldehyde.

OFFICE OF PRICE ADMINISTRATION AND CIVILIAN SUPPLY

1.—CHAPTER XI

PART 1335—CHEMICALS

CIVILIAN ALLOCATION PROGRAM FOR FORMALDEHYDE, PARA - FORMALDEHYDE, HEXAMETHYLENETETRAMINE, AND SYNTHETIC RESINS PRODUCED THEREFROM

The increasing requirements of the defense effort and the use of plastics as substitutes for other materials have combined to create a shortage of plastics, synthetic resins, and the components of such resins. The diminished amount of such materials, as well as the essential functions such materials serve, makes it necessary that available supplies be utilized in such a way as best to promote the national well-being.

Accordingly, pursuant to and under the authority vested in me by Executive Order No. 8734,[2] particularly section 2 (a) thereof, the following program is announced:

§ 1335.21 *Allocation of materials for plastics.* Non-defense uses of molding compounds, plastics, adhesives, and miscellaneous binders, made from synthetic resins shall be divided into three classifications, as set forth in § 1335.23 of this program. To the extent that supplies of resins made directly or indirectly from formaldehyde are available for allocation among competing civilian demands, supplies for civilian uses enumerated under classification (a) shall be given primary preference, and supplies for civilian uses enumerated under classification (b) shall be given secondary preference. Supplies of such resins for civilian uses enumerated uner classification (c) shall be given no preference whatever, and no person shall produce, sell, or use resins made directly or indirectly from formaldehyde for the making of molding compounds, plastics, adhesives, and miscellaneous binders for such classification (c) uses, nor shall any person produce, sell, or use formaldehyde, para-formaldehyde, or hexamethylenetetramine for the making of resins from which molding compounds, plastics, adhesives, and miscellaneous binders for such classification (c) uses are to be made. *Provided however*, that products that would otherwise be classified under Classification (c), which are composed to the extent of 90% or over, by value, of raw materials other than formaldehyde, para-formaldehyde, or hexamethylenetetramine resins, and in which the formaldehyde resins are essential, shall be classified under Classification (b).*

§ 1335.22 *Nature of uses granted preferences.* In classifications (a) and (b), preference shall be granted only to those uses of resins which are essential to the functioning of the classified part or material, and preference shall not be granted to such uses if satisfactory substitutes are available. The quantities allocated for the production of articles in classification (b) may be limited in amount, in which event such limited amount shall be equitably distributed among producers. In the event that classification of any article under classification (c) works any undue or unreasonable hardship or causes unemployment disproportionate to the conservation of raw materials, special exceptions for such lengths of time as may be deemed necessary may be made by the Director of Priorities of the Office of Production Management, with the concurrence of the Director of Civilian Allocation of the Office of Price Administration and Civilian Supply.*

§ 1335.23 *Classification by uses.* Subject to the provisions of § 1335.22, classification by uses shall be as follows:

(a) Public and industrial heat, light, power and water equipment.
Transportation equipment—including accessories to commercial airplanes.
Trucks, buses, tractors, firefighting and farm implements.
Technical instruments.
Material and equipment for scientific research.
Chemical protective uses.
Applications in the communications industry (telephone and telegraph)
Industrial equipment.
Oil well equipment.
Housing, other than protective coatings.
Mining.
Industrial, food, and medicinal containers, and protective coverings therefor.
Closures, except decorative.
Marine applications.
Grinding wheels and other abrasive products.

(b) Tables and kitchenware, save as expressly classified under (c).
Protective coatings not otherwise specified.
Radios.
Household appliances.
Textile finishing.
Domestic wiring devices.
Passenger automobiles.
Buttons.
Brushes.
Furniture.
Pipe stems.
Commercial cameras and other commercial photographic equipment.
Articles fashioned from standard casts by hand operations.

(c) Amateur cameras and other amateur photographic equipment.
Hardware.
Smokers' articles, except pipe stems.
Decorative articles, vases, bric-a-brac, not otherwise specified.
Tumblers, cups, and plates.
Premium and advertising items.
Novelties, not otherwise specified.
Buckles and findings, not otherwise specified.
Displays.
Escutcheon plates.
Picture frames.
Toys.
Games.
Phonographs.
Minor utilitarian items easily substitutable—bookends, stationers' articles, mechanical pencils, and the like.
Articles or uses excluded from classification (a) and classification (b) by § 1325.3.*

§ 1335.24 *Allocation of formaldehyde for non-plastic uses.* Formaldehyde, paraformaldehyde, and hexamethylenetetramine for all non-plastic uses shall receive the same preference as such materials receive for uses classified under classification (a) of § 1335.23.*

§ 1335.25 *Avoidance of excessive inventories.* Preferences granted under this program shall not be used to accumulate excessive inventories.*

§ 1335.26 *Definitions.* For the pur-

[2] 6 F.R. 1917.

* §§1335.21 to 1335.28, inclusive, issued pursuant to the authority contained in Executive Order No. 8734.

pose of this order, "person" means and includes any individual, partnership, association, corporation, or other form of enterprise.*

§ 1335.27 *Enforcement.* The foregoing program is to be administered and enforced by the Office of Production Management.*

§ 1335.28 *Effective Date.* This order shall take effect on the 23rd day of August, 1941.*

Issued this 31st day of July, 1941.

LEON HENDERSON, *Administrator.*

[F.R. Doc. 41-5660; Filed, August 2, 1941; 11:29 a. m.]

2. OFFICE OF PRODUCTION MANAGEMENT

GENERAL PREFERENCE ORDER NO. M-25

TO CONSERVE THE SUPPLY AND DIRECT THE DISTRIBUTION OF FORMALDEHYDE, PARAFORMALDEHYDE, HEXAMETHYLENETETRAMINE AND SYNTHETIC RESINS PRODUCED THEREFROM

WHEREAS, the national defense requirements have created a shortage of Formaldehyde, Paraformaldehyde, Hexamethylenetetramine and Synthetic Resins produced therefrom, for defense, for private account, and for export and it is necessary, in the public interest and to promote the defense of the United States, to conserve the supply and direct the distribution thereof;

Now, therefore, it is hereby ordered that:

967.1 *General Preference Order.*

(a) *Definitions.* For the purpose of this Order:

(1) "Person" means any person, firm, corporation, or other form of business enterprise.

(2) "Producer" means any Person engaged in the production of Formaldehyde, Paraformaldehyde, Hexamethylenetetramine or Synthetic Resins produced therefrom and includes any Person who has the foregoing products produced for him pursuant to toll agreement.

(3) "Defense Order" means:

(i) Any contract or order for material or equipment to be delivered to, or for the account of:

1. The Army or Navy of the United States, the United States Maritime Commission, the Panama Canal, the Coast and Geodetic Survey, the Coast Guard, the Civil Aeronautics Authority, the National Advisory Commission for Aeronautics, the Office of Scientific Research and Development;

2. The government of any of the following countries: The United Kingdom, Canada and other Dominions, Crown Colonies and Protectorates of the British Empire, Belgium, China, Greece, The Kingdom of the Netherlands, Norway, Poland, Russia and Yugoslavia.

(ii) Any contract or order placed by any agency of the United States Government for delivery to, or for the account of, the government of any country listed above or any other country in the Eastern Hemisphere pursuant to the Act of March 11, 1941, entitled "An Act to Promote the Defense of the United States." (Lend-Lease Act.)

(iii) Any other contract or order to which the Director of Priorities assigns a preference rating of A-10 or higher.

(iv) Any contract or order placed or offered by any person for the delivery of any material all of which is to be physically incorporated into material or equipment to be delivered under specific contracts or orders included under (i), (ii), and (iii) above.

(b) *Preference Ratings and Directions.* Deliveries of Formaldehyde, Paraformaldehyde, Hexamethylenetetramine and Synthetic Resins produced therefrom shall be made in accordance with the following directions:

(1) Deliveries under Defense Orders shall be made in preference to deliveries under all other orders whenever, and to the extent, necessary to assure fulfillment of the delivery schedule specified in such Defense Orders or in any individual preference rating certificates assigned thereto, whichever schedule be earlier.

(2) Preference ratings, in order of precedence, are: AA, A-1-a, A-1-b, etc., A-1-j; A-2, A-3, etc., . . . A-10.

(3) Deliveries under all Defense Orders which have not been assigned a higher preference rating are hereby assigned a preference rating of A-10.

(4) Defense Orders for Formaldehyde, Paraformaldehyde, Hexamethylenetetramine or Synthetic Resins produced therefrom, whether or not accompanied by a Preference Rating Certificate, must be accepted and fulfilled in preference to any other contracts or purchase orders for such Material, subject to the following provisions:

(i) Defense Orders must be accepted even if acceptance will render impossible, or result in deferment of:

1. deliveries under non-defense orders previously accepted, or

2. deliveries under Defense Orders previously accepted bearing lower preference ratings, unless rejection is specifically permitted by the Director of Priorities.

(ii) Defense Orders need not be accepted

1. if delivery on schedule thereunder would be impossible by reason of the requirements of Defense Orders previously accepted bearing higher or equal preference ratings, unless acceptance is specifically directed by the Director of Priorities;

2. if the Person seeking to place the Defense Order is unwilling or unable to meet regularly established prices and terms of sale or payment, but there shall be no discrimination against Defense Orders in establishing such prices or terms;

3. if the Formaldehyde, Paraformaldehyde, Hexamethylenetetramine or Synthetic Resins produced therefrom ordered are not of the kinds usually produced or capable of being produced by the Person to whom the Defense Order is offered;

4. if such Defense Orders specify deliveries within fifteen days, and if compliance with such delivery dates would require the termination before completion of a specific production schedule already commenced.

(c) *Directions with Respect to Residual Supply.* After providing for all deliveries under Defense Orders giving preference among such deliveries in accordance with any preference ratings specifically assigned thereto, deliveries of Formaldehyde, Paraformaldehyde, Hexamethylenetetramine and Synthetic Resins produced therefrom under other contracts or orders shall be made in accordance with the following directions:

(1) Non-defense uses of molding compounds, plastics, adhesives and miscellaneous binders made from Synthetic Resins shall be divided into the following three classifications:

(i) Classification I.

Public and industrial heat, light, power and water equipment

Transportation equipment—including accessories to commercial airplanes

Trucks, buses, tractors, fire-fighting and farm implements

Technical instruments

Material and equipment for scientific research

Chemical protective uses
Applications in the communications industry
Industrial equipment
Oil well equipment
Housing, other than protective coatings
Mining
Industrial, food, and medicinal containers and protective coverings therefor
Closures, except decorative
Marine applications
Grinding wheels and other abrasive products

(ii) Classification II.

Tables and kitchenware, save as expressly classified under III
Protective coatings not otherwise specified
Radios
Household appliances
Textile finishing
Domestic wiring devices
Passenger automobiles
Buttons
Brushes
Furniture
Pipe stems
Commercial cameras and other commercial photographic equipment
Articles fashioned from standard casts by hand operations
Paper treatment
Containers not otherwise specified

(iii) Classification III.

Amateur cameras and other photographic equipment
Hardware
Smokers' articles, except pipe stems
Decorative articles, vases, bric-a-brac, not otherwise specified
Tumblers, cups, and plates
Premium and advertising items
Novelties, not otherwise specified
Buckles and findings, not other wise specified
Displays
Escutcheon plates
Picture frames
Toys
Games
Phonographs
Minor utilitarian items easily substitutable — bookends, stationers' articles, mechanical pencils, and the like
Articles or uses excluded from Classifications I and II (and therefore denied preference ratings) pursuant to paragraph (c) (2) below, because either the use of resins with respect to them is not essential to their functioning or satisfactory substitutes for resins therefor are available.

Provided, however, that articles that would otherwise be classified under Classification III, which are composed to the extent of 90% or over by value of raw materials other than Formaldehyde, Paraformaldehyde, or Hexamethylenetetramine Resins, and in which the Formaldehyde Resins are essential, shall be classified under Classification II. In the event that classification of any product under Classification III works any undue or unreasonable hardship or causes unemployment disproportionate to the conservation of raw materials, special exceptions for such lengths of time as may be deemed necessary may be made by the Director of Priorities of the Office of Production Management, with the concurrence of the Director of Civilian Allocation of the Office of Price Administration and Civilian Supply.

(2) Deliveries of Resins made directly or indirectly from Formaldehyde for non-defense uses, enumerated in Classification I, are hereby assigned a preference rating of B-4, and deliveries of Resins made directly or indirectly from Formaldehyde for non-defense uses, enumerated under Classification II, are hereby assigned a preference rating of B-8. In Classifications I and II, the preference ratings, hereinabove mentioned in this paragraph (c) (2), are granted only to deliveries of Resins the use of which is essential to the functioning of the classified article or use; and no such preference ratings are assigned to deliveries of Resins if satisfactory substitutes therefor are available. The quantities of Resins available for the production of articles in Classification II may be limited in amount, in which event such limited amount shall be equitably distributed.

(3) No Persons, shall produce, sell, or use Resins made directly or indirectly from Formaldehyde for the making of molding compounds, plastics, adhesives, and miscellaneous binders for non-defense uses enumerated in Classification III, nor shall any Person produce, sell, or use Formaldehyde, Paraformaldehyde, or Hexamethylenetetramine for the making of Resins from which molding compounds, plastics, adhesives, and miscellaneous binders for non-defense uses enumerated in Classification III are to be made.

(4) Deliveries of Formaldehyde, Paraformaldehyde, and Hexamethylenetetramine for all non-defense nonplastic uses are hereby assigned a preference rating of B-4.

(d) *Grievances.* When deliveries of Formaldehyde, Paraformaldehyde, Hexamethylenetetramine or Synthetic Resins produced therefrom have been unreasonably or improperly deferred, or when orders therefor have been rejected (for any reason other than the restrictions contained in this Order), the Person aggrieved may file with the Division of Priorities a verified report in form to be prescribed by the Division of Priorities, attention Chemicals Section, setting forth the facts in connection with such deferment or rejection.

(e) *Doubtful Cases.* Whenever there is a doubt as to the preference rating applicable to any delivery, or whether an order or contract placed or offered to be placed, constitutes a Defense Order, the matter should be referred to the Division of Priorities for determination with a statement of all pertinent facts.

(f) *Excessive Inventories.* The preference ratings granted by this Order shall not be used to accumulate excessive inventories.

(g) *Records, Information, and Inspection.* All persons affected by this Order shall keep and preserve, for a period of not less than two years, accurate and complete records of their inventories of Formaldehyde, Paraformaldehyde, Hexamethylenetetramine and Synthetic Resins produced therefrom, and of the details of all transactions in any way regulated or affected by this Order. Such records shall include the dates of all contracts or orders accepted; the delivery dates specified in such contracts or orders, and in any Preference Rating Certificates accompanying them; the dates of actual deliveries thereunder; description of the material covered by such contracts or orders; description of deliveries by classes, types, quantities, and weights; and preference ratings, if any, assigned to such contracts or orders or to deliveries thereunder; the parties involved in each transaction; their sources of supply; and other pertinent information. All records specified in this paragraph shall, upon request, be submitted to audit and inspection by duly authorized representatives of the Division of Priorities. All Persons affected by this Order shall execute and file with the Division of Priorities such reports and questionnaires as said Division shall from time to time request. No reports or questionnaires are to be filed by any Person until so requested and until forms therefor are prescribed by the Division of Priorities.

(h) *Appeal.* Except as otherwise provided in paragraph (c) (1) above, any Person affected by this Order who considers that compliance therewith would work an exceptional and unreasonable hardship upon him, may appeal to the Division of Priorities by addressing a letter to the Division of Priorities, Office of Production Management, Social Security Building, Washington, D. C., setting

forth the pertinent facts and the reasons such Person considers that he is entitled to relief. The Director of Priorities may thereupon take such action as he deems appropriate.

(i) *Effective Date.* This Order shall take effect on the 23rd day of August, 1941, and, unless sooner terminated by direction of the Director of Priorities, shall expire on the 31st day of December, 1941. (O.P.M. Reg. 3, March 7, 1941, 6 F.R. 1596; E.O. 8629, January 7, 1941, 6 F.R. 191; Sec. 2 (a), Public No. 671, 76th Congress, as amended by Public No. 89, 77th Congress; Sec. 9, Public No. 783, 76th Congress.)

Issued this 20th day of August, 1941.

E. R. STETTINIUS, JR. *Director of Priorities.*

OFFICE OF PRICE ADMINISTRATION AND CIVILIAN SUPPLY

3. CHAPTER XI

PART 1335—CHEMICALS

PRICE SCHEDULE NO. 21—FORMALDEHYDE

Increasing demands for formaldehyde in the manufacture of synthetic resins for military and civilian needs have created a shortage of supply. Speculators have taken advantage of this situation to raise the resale price of appreciable quantities of formaldehyde to as high as 47¢ per pound, contrasted with the manufacturers' price of 6¢ per pound for comparable quantities. These speculative prices are threatening to rise to even higher levels. It is necessary to curb such speculation in order to protect consumers, to eliminate the danger of price rises in other industries that use formaldehyde, and to promote stable contractual relationships.

Accordingly, under the authority vested in me by Executive Order No. 8734, it is hereby directed that:

§ 1335.51 *Maximum prices for formaldehyde.* On and after August 20, 1941, regardless of the terms of any contract of sale or purchase, or other commitment, no person shall sell, offer to sell, deliver or transfer, formaldehyde in containers of 45 lbs. or more, and no person shall buy, offer to buy, or accept delivery of, formaldehyde in containers of 45 lbs. or more, at prices higher than the maximum prices set forth in Appendix A, incorporated herein as § 1335.60.*

§ 1335.52 *Less than maximum prices.* Lower prices than those set forth in Appendix A may be charged, demanded, paid or offered.*

§ 1335.53 *Evasion.* The price limitations set forth in this Schedule shall not be evaded whether by direct or indirect methods in connection with a purchase, sale, delivery, or transfer, of formaldehyde, or in connection with a purchase, sale, delivery, or transfer of any other material, or by way of any commission, service, transportation, or other charge, or discount, premium, or other privilege, or by tying-agreement or other trade understanding, or otherwise.*

§ 1335.54 *Records.* Every person making purchases or sales of formaldehyde in containers of 45 lbs. or more shall keep for inspection by the Office of Price Administration and Civilian Supply for a period of not less than one year complete and accurate records of each such purchase or sale, showing the date thereof, the name and address of the buyer or the seller, the price paid or received, and the specifications and quantity, including the size of the containers, of the formaldehyde purchased or sold.*

§ 1335.55 *Affirmations of compliance.* On or before September 10, 1941, and on or before the 10th day of each month thereafter, every person who, during the preceding calender month, has sold formaldehyde in containers of 45 lbs. or more, whether for immediate or future delivery, shall submit to the Office of Price Administration and Civilian Supply, an affirmation of compliance on Form 121:1[1] containing a sworn statement that during such month all such sales were made at prices in compliance with this Schedule or with any exception or modification thereof. Copies of Form 121:1 can be procured from the Office of Price Administration and Civilian Supply, or, provided that no change is made in the style and content of the Form and that it is reproduced on 8 x 10½" paper, they may be prepared by persons required to submit affirmations of compliance hereunder.

§ 1335.56 *Enforcement.* In the event of refusal or failure to abide by the price limitations, report requirements, or other provisions contained in this Schedule, or in the event of any evasion or attempt to evade the price limitations or other provisions contained in this Schedule, the Office of Price Administration and Civilian Supply will make every effort to assure (a) that the Congress and the public are fully informed thereof, and (b) that the powers of the Government are fully exerted in order to protect the public interest and the interests of those persons who comply with this Schedule. Persons who have evidence of the offer, receipt, demand or payment of prices higher than the maximum prices, or of any evasion or effort to evade the provisions hereof, or of speculation, or manipulation of prices of formaldehyde, or of the hoarding or accumulating of unnecessary inventories thereof, are urged to communicate with the Office of Price Administration and Civilian Supply.*

§ 1335.57 *Modification of the schedule.* Persons complaining of hardship or inequity in the operation of this Schedule may apply to the Office of Price Administration and Civilian Supply for approval of any modification thereof or exception therefrom.*

§ 1335.58 *Definitions.* When used in this Schedule, the term:

(a) "Person" means an indiviual, partnership, association, corporation, or other business entity;

(b) "Formaldehyde" means (1) U.S.P. solution of formaldehyde (37% formaldehyde by weight) or (2) any other solution of formaldehyde except lots or quantities sold for commercial use as embalming fluids;

(c) "Producer's shipping point" means any of the following points: Garfield, N. J., Perth Amboy, N. J., West Haverstraw, N. Y., or Tallant, Oklahoma.*

§ 1335.59 *Effective date of the schedule.* This Schedule shall become effective August 20, 1941.*

§ 1335.60 *Appendix A*—(a) *Maximum prices for formaldehyde shipped from producers' shipping points.*

Quantity in pounds and containers	Price per pound FOB New York, N. Y., or West Haverstraw, N. Y., or Garfield, N. J., or Perth Amboy, N. J., or Tallant, Oklahoma, freight equalized.	
	Carload lots	Less-than-carload lots
Tank cars (70,000–72,000 lbs.)	$0.0425	$0.0450
Tank truck or wagon	.0540	.0590
Drums (475 lbs.)	.0575	.0625
Barrels (450 lbs.)	.0675	.0725
Kegs (225 lbs.)	.0675	.0725
Half barrel (225 lbs.)	......	.0725
Barrels (200 lbs.)	.0700	.0750
Keg (125 lbs.)	.0600	.0650
Carboys (100 lbs.)	.0750	.0800
Kegs (90 lbs.)	.0800	.0850
Kegs (60 lbs.)	.0700	.0750
Carboys (45 lbs.)	......	.0850
Drums (45 lbs.)	.0900	.0950
Kegs (45 lbs.)		

The maximum price which a purchaser may pay under this Schedule for formaldehyde shipped to him from a producer's shipping point shall not exceed the maximum price set forth above plus freight to destination from New York, N. Y., West Haverstraw, N. Y., Garfield, N. J., Perth Amboy, N. J., or Tallant, Oklahoma, whichever is less.

In no case shall the price of any quantity of formaldehyde sold in containers holding 45 lbs. or more, but not listed above, exceed the maximum price set forth above for a container holding the next greater quantity.

(b) *Maximum prices for formaldehyde delivered from local stocks.* The maximum price for formaldehyde delivered from local stocks maintained at points other than producers' shipping points shall not exceed a price ex seller's warehouse greater than the maximum prices set forth above plus freight to seller's warehouse from New York, N. Y., West Haverstraw, N. Y., Garfield, N. J., Perth Amboy, N. J., or Tallant, Oklahoma, whichever is less, plus one cent per pound.*

Issued this 20 day of August, 1941.

LEON HENDERSON, *Administrator.*

[F.R. Doc. 41-6234; Filed, August 20, 1941; 11:50 a. m.]

No. 163——4

* §§ 1335.51 to 1335.60, inclusive, issued pursuant to authority contained in Executive Order No. 8734.

[1] Not filed as part of original document.

Going Places

A WHOLE family of plastics has been gathered together for the interior of the club car, "Hollywood," of the City of Los Angeles, streamlined train which recently went into service on the Chicago North Western Pacific Line. Gray, white and bright red are combined in the general color scheme. The velvety white wall panels have a laminated plastic that is easily cleaned and long wearing. Furniture is constructed partly of this material. Above and below the panels and at the car end, bulkheads and doors are silver finished "Leatherwall," a new product of the leather industry made from the finest quality hides and finished with cellulose nitrate. Plants of fabricated methyl methacrylate "grow" out of silver finished boxes. (Shown lower right of the photo above.)

Furniture itself is pleasantly arranged in groups for convenience. Decorative push-back chairs make use of smooth, washable woven vinylidene chloride strips in a rattan-like effect for its yellow and red plaid backs. The red body of the chair uses nylon for inside upholstery. The floor covering is a gunmetal broadloom.

The windows are circular. This port-hole effect gives the car a slightly nautical air which is pleasantly different from the usual square window covered conventionally with drapes. A bar, with a long-wearing, laminated plastic top, is at the far end of the car.

Another streamlined train (below) that makes use of plastics is the James Whitcomb Riley for the New York Central System, which runs between Cincinnati and Chicago. The bar car is illuminated by fluorescent lighting fixtures with lightweight, washable molded urea shades along the sides. The bar top and tables are of laminated plastic—to resist cigaret burns, alcohol stains, and permit speedy cleaning.

Credits: Pyralin, Formica, Saran, Lucite, used in decorations of Chicago Northwestern Railway club car. Developed by E. W. Beck, of Mandel Brothers, and Walter Kuhn, consulting architect for the Union Pacific Railroad. Formica for New York Central System train. Designed by Henry Dreyfus.

Semi-transparent nitro-cellulose hosiery forms given a smooth, gleaming surface by the use of belt-grinding machines. Rough cutting is done by machine with a wet sanding belt (left) and final finishing by a fine belt machine (right)

Belt-Grinders

By S. S. Mellor*

FINISHING plastics on belt grinders has now become so widely known and generally accepted by progressive plastic plants everywhere that on many articles and parts hand filing and scraping have been entirely eliminated. The result has been saving in time, increased production and better all-around results for everyone concerned.

An interesting example of this transition occurred in the Shoe Form Co. of Auburn, N. Y. Their product is a semi-transparent hosiery display form composed of nitrocellulose. Previous to the installation of these belt grinders the finishing had to be done by hand because any equipment generating frictional heat caused the plastics to melt, warp and flow. The thermoplastic forms must, of course, be absolutely smooth as any slight roughness would damage the sheer stockings displayed on them. Coming from the heated steel molding die, after being formed from sheet celluloid, the joint excess must be ground down with the curved surface retained. Two belt grinders were installed to perform the finishing. One unit handled the initial rough cutting. The other using a finer grade of sanding belt did the final finishing. By replacing hand work with these belt grinders costs were saved by reducing the piece-work rate. Abrasive paper costs were lowered by $66^2/_3$ percent, and production increased. In addition, the forms had a superior finish to the ones which were previously done by hand methods.

Several companies are now making grinding belts with the abrasive bonded to the backing cloth with a waterproof resinous compound. The use of these belts, either wet or dry, is proving considerable economy compared to glue bonded and joined belts. A plastic radio case manufacturer found some of his cases coming from the mold slightly warped. In order to make the surface absolutely even by sanding would have required several hours. By using a wet belt sander, with a 10-in. belt, the job was done in 3 minutes. His rejects were decreased to a minimum. As is often the case, plastic bases of various kinds come from the molds uneven and must be ground down to make them level. A belt grinder, with solid, level backing plate grinds them down evenly by a mere touch of the base against the belt. (*Please turn to page 84*)

* Sales Promotion Manager of Porter-Cable Machine Company.

Laundry gets the gun

IMPORTANT redesign job and switch from metal to plastics is this highly efficient lightweight spray gun used in the textile field for moistening fabrics before ironing or pressing. The operation of the gun needed no improvement, but after five years of service it was considered desirable from the standpoint of sales and production costs to put a new one on the market. There was a demand for greater ease of operation, less weight, better appearance and reduction in cost to justify the expense of redesigning, tools and new promotion. The new model is housed in a 2-piece, crimson, molded cellulose acetate butyrate body styled to sell.

Simply operated, atomization in the gun is produced by passing the water through a spiral plunger or needle. The water strikes against the orifice plate at considerable velocity and emerges in a fine conical shaped spray. Because of this, compressed air is not needed—just a water line by means of a flexible hose. It was important in the design to avoid dripping after the spray had been shut off. One spot might mean ruin to a garment and extra hours of work for the operator. The gun, therefore, features a shut-off that prevents dripping. Consideration of the handling ease led to placing the axis of the spray at about 45 deg. to the handle. This permitted the hand to be held naturally when spraying. Another improvement was to have the gun designed so that hose connection could be made at bottom of handle, or rear of gun as best suited the operator. A 2-finger trigger was used to reduce operating fatigue.

After mechanical features were settled for the gun, a design was developed that used a light zinc die casting which formed a strong metal skeleton to carry the water passages, operating details and provided the necessary backing for a light, molded cellulose acetate butyrate cover. In order to prevent corrosion, the zinc die casting was given a flash of bright nickel plate on the outer surface and the water passages a coat of baked alkyd resin base varnish. The die cast frame or insert is machined and completely assembled. It is then sent to the molder who applies the plastic body and returns it for final finishing.

Bodies are molded in two halves with dowels on one half and sockets on the other to insure proper mating of parts. The two halves are assembled over the insert and joined by an acetone cement. The plastic bodies are then returned to the company for assembly and test.

The decision between an aluminum die casting and a plastic covered zinc die casting was influenced entirely by costs as it was assumed that either would be satisfactory from the standpoint of appearance and weight. While the die cost for the aluminum die casting was considerably less than the combined costs of the molds for the zinc die casting and the plastic halves of the cover, the lower cost of the plastic assembly more than made up the difference. This difference is mainly the cost of polishing and anodizing the aluminum die casting. The plastic parts, of course, come from the mold with the color and luster of the finished article without further operations. Cellulose acetate butyrate was chosen as the plastic because of its color, luster, flexibility and resistance to breakage by impact.

The redesign has not only produced a better gun in performance, appearance and convenience than the previous model, but also costs less. It has also reduced weight from 17 to 7 ounces.

Credits: Tenite II molded by Bay Co. for DeVilbiss Co. Designed by Sundberg and Ferar Glyptal varnish.

TENITE

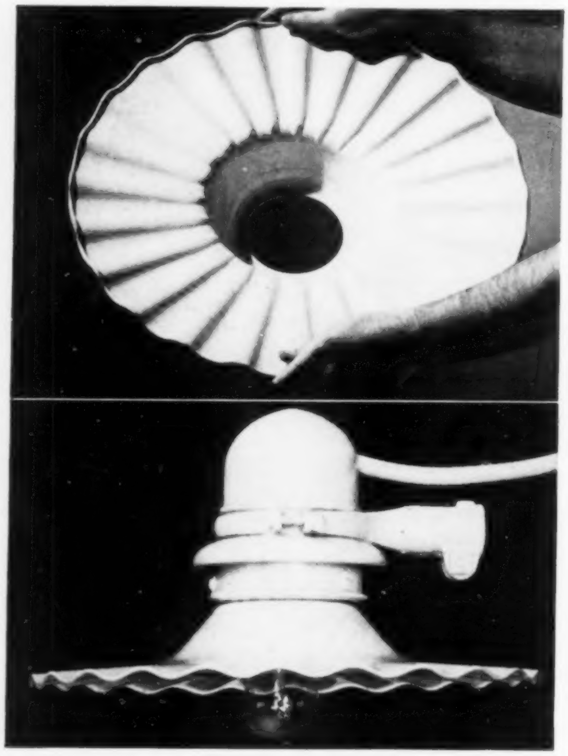
Product Development

Cellulosic Selectors

Plastics have already done yeoman service for their country in two draft lotteries. In the first lottery they did double duty—extended dimensions of the original Gold Fish Bowl, which was not deep enough, with a transparent 12 in. wide cellulose sheet attached to the top, in order to hold the actual number—containers. In the first draft lottery, of October 1940, the capsules were small blue nitrocellulose telescope tube containers with the printed number inside (shown in the foreground). The capsules of the July 17, 1941, selective service lottery were melon color (shown in the back) with threaded top of cellulose acetate and closed by a metal screw cap. Capsules were made by a patented solution process, the method of manufacture of which consisted of forming a viscose dope over a mandrel. The viscosity of the solution is formulated to the proper consistency to cause it to adhere to the mandrel. It is set, or dried, under controlled atmospheric conditions and the formed capsules removed from the mandrels, spray-colored and finished. More common uses for capsules made in this fashion are as containers for lipstick refills, mechanical pencil leads, pills, tablets and other pharmaceutical purposes.

Credits: Hycoloid, Clearsite—manufactured by Celluplastic Corporation

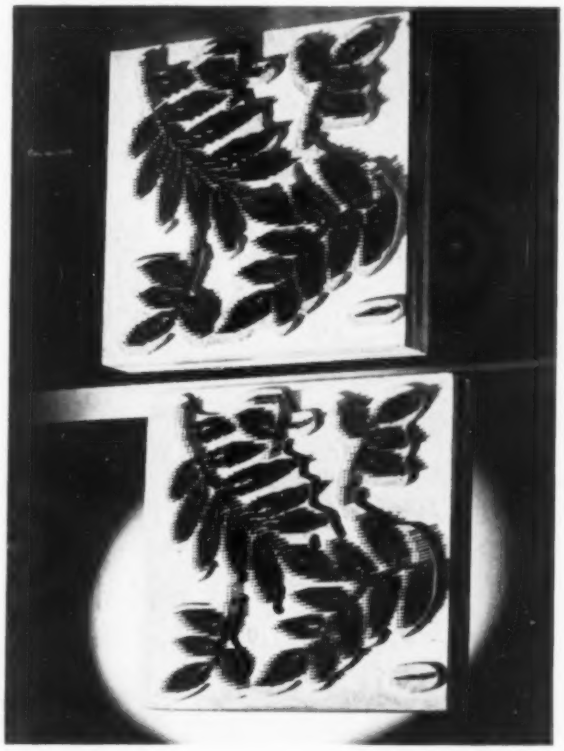
Street light reflector



Adequate street and highway illumination rates as an important safety factor throughout this "land of light." For the Novalux Luminaire, new outdoor unit, a molded laminated phenolic compound is the basis of the durable and goodlooking Radial Wave Street Lighting Reflector with its wide flaring, scalloped edge. The designer had to choose a material as strong, or stronger than the previous metal type, and to improve its general wearing qualities and appearance. The very nature of molded-laminated phenolic helped solve these problems for it is light, rust- and warp-proof. Furthermore, it is easily machined, has high tensile and impact strength and possesses color that ranges from transparency to opacity, making it the perfect reflector. Covered with an alkyd resin, the plastic reflector is green on top and white underneath. The finish is then baked on. This was found to overcome the occasional pitting common to aluminum finished reflectors. Another advantage is that the light can easily be cleaned, or completely recoated. Tests were made by the company 2 years ago in an industrial section where grime and dust, as well as the elements, had a chance to do their work. When tested for deterioration, the amount was negligible.

Credits: Textolite covered with Glyptal. Designed and molded by General Electric Company

Product Development



Pin mash block

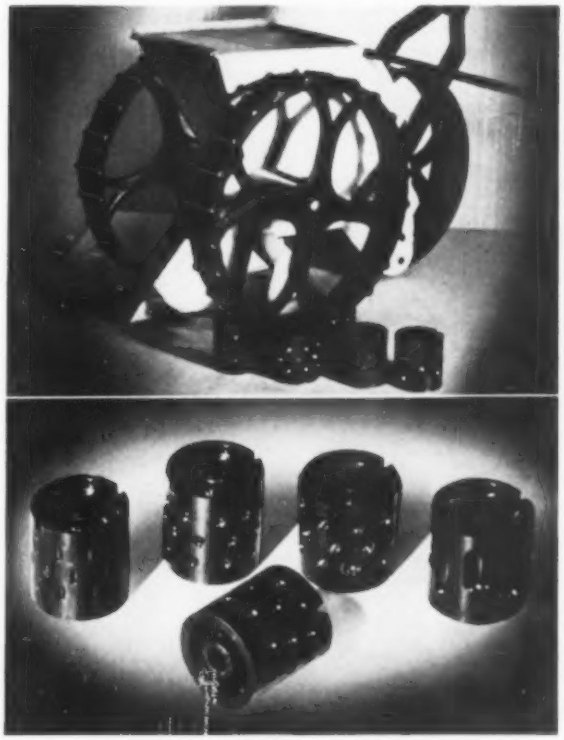
Boon to the printer is the Pin block with a plastic face. Its advantages over the regular wooden face are many, but mainly because it eliminates the "chocking" of pins and enables the operator to clean the block without danger of breaking the pins. Known to the trade as a "pin mash block," this delicate device was constantly in need of repair. Since there was a tendency for the paint to choke up between the pins, it was necessary to clean it out with a brush. In cleaning, pins often would come loose and break off. These broken pins were replaced by driving in brass pins, which took considerable time. With the new plastic face the pins do not choke and can readily be cleaned without danger of breakage. Care must be taken not to use alcohol or acetone in cleaning as this may soften it. Another advantage of the plastic face is that the operator can cut deeper. The block prints better and, furthermore, it will last from 5 to 8 times as long as a wooden pin block, according to its manufacturers. If the composition face block must be repaired with brass pins, the pins will not come loose as they do with the wooden block. The blocks are 10 by 10 in.

Credits: Cellulose sheet furnished by Monsanto Chemical Co., for P. D. K. Print Block Co., and manufactured by Dienelt and Eisenhart Co.

Garden Seeder

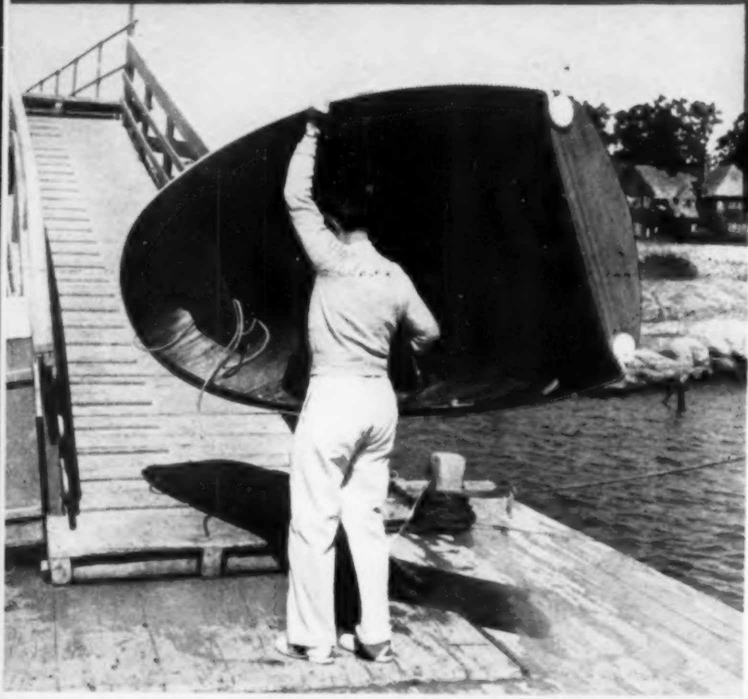
A unique but nevertheless logical use of plastics is the application of molded phenolic to a well-known Garden Seeder. The properties of the material and its lightness have resulted in a machine that is perfect for the small truck and home gardener who wants the best equipment at a reasonable figure. It is the seed disks, or seed distribution wheels, that are molded. The molded part requires a split mold in order to obtain the necessary indentations on the sides of the cylindrical shape. Each depression is of uniform size and 5 different sizes are furnished with each unit. These 5 units take care of all seed sizes up to and including peas. Other sizes are available on request. The seeder operates on a master wheel and therefore there are no chains or gears to get out of order or wear out. Plastic disks permit simple, adjustable arrangement for accurate spacing of seeds. There is also a special brush arrangement to prevent the cracking or grinding of seeds. An adjustable handle arrangement permits the operator to follow without treading on the seeds that he has just planted. Shipping costs are cut since this new device weighs only 16 lbs. Its strength and hardness make it a durable garden tool. The material itself is resistant to heat.

Credits: Durez molded by Northwest Plastics, Inc. for Gregg Mfg. Company



Economy Cruisers

Phennlic-bonded plywood is used for light, roomy, speedy boats. Acrylic sheet forms the windows



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TWO boats that make extensive use of plastics have caught the imagination of boating enthusiasts this season. One is a "build-it-yourself" boat and the other weighs so little that it can be strapped to the top of your car as easily as a pair of skis.

The small boat (Fig. 1) has a homogenous waterproof one-piece hull construction, and weighs only 60 lbs. It makes use of the Hydrolite process for molding lightweight, one-piece dinghies of phenol-formaldehyde. The other craft, by Doane (Figs. 4–5) which can be built from plans alone, according to the manufacturer, is made of plastic-bonded plywood with lightweight transparent acrylate windows.

Both are economically built and run for a maximum of speed. It is claimed that the Doane Cruiser takes less than 3 cents a day to run. In appearance it greatly resembles an airplane and, as a matter of fact, gets its unusual contours from the Boeing Clipper hull designs. In the directions for "Build your own Speed Ship" the entire project is broken down into about 40 steps with detailed descriptions on material dimensions, size of fastenings, how to assemble and finish and easily understood sketches are included.

Because weight is the greatest single factor governing ship speeds, every necessary lb. is pared. For example, great weight savings were made by replacing the

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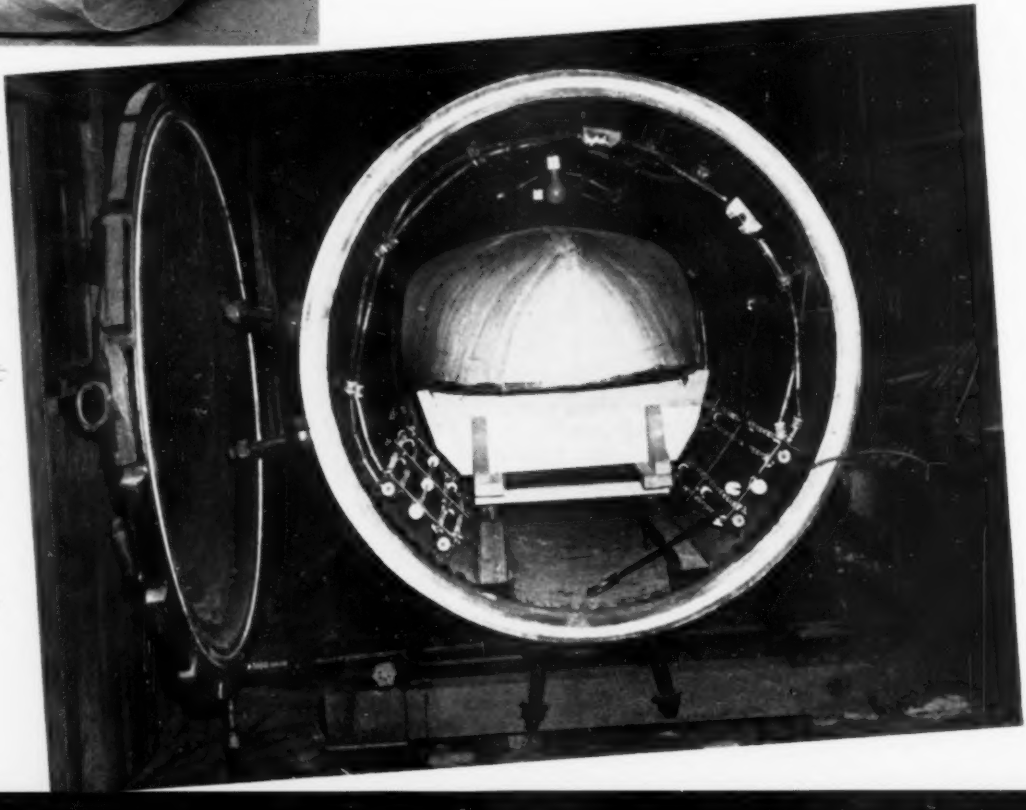


20 ft. of plate glass with acrylic sheet stock, the transparent plastic used for plane cockpit enclosures. This material is tough and unaffected by sun, wind and sea.

The resin-bonded plywood, also employed in airplane construction, is stronger per pound than steel and cuts hull weight by a third. It is used in large sheets on the "stressed skin" principle, thus making a single unit of the planking, ribs, keel and deckhouse. It requires only one-fifth as many seams as conventional deflectors, such as used on the new mile-a-minute navy torpedo boats, and a "flying stern" that rides out of the water at high speed. This permits level planing.

The Hydrolite processed craft is definitely one for wandering nomads. Vacationers need not worry where to hire boats because this waterproof craft can be strapped on the car so easily. The one-piece hull is composed of a multiplicity of thin mahagony veneers, fused together with a special phenolic plywood resin under heat and pressure.

In simple terms, the process consists of first building a mold, reproducing in its entirety the hull form of the design selected. Three full layers of veneer in narrow strips are laid diagonally over this form. Each layer has been carefully treated with the wood bonding phenolic resin. By mortising out the mold where extra thickness or strength is required, extra layers of veneer are inserted. Thus, the hull can be built up to as many layers as desired, giving extra backing where wanted.

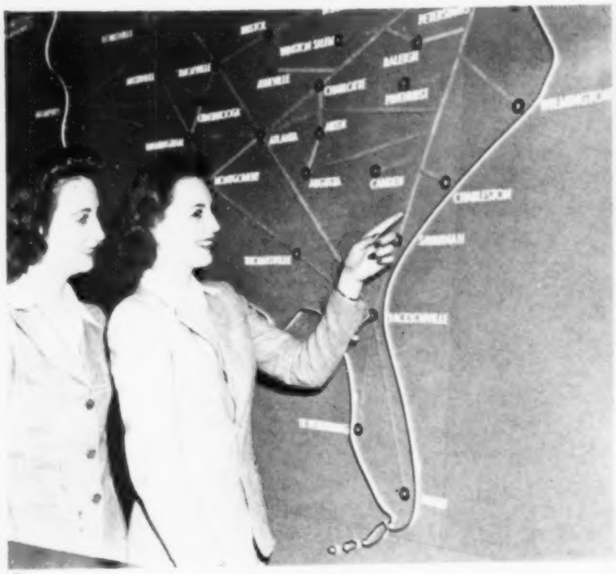
It is claimed by the manufacturer that this process produces one of the strongest materials per pound of weight that has ever been used for small boat building. The hulls of these dinghies, reports the company, will stand up under the severest concentrated blows. Because of the great strength of the material, heavy braces and supports are eliminated, to reduce weight. The dinghy only 8 ft. long, holds 5 passengers.

Credits: Bakelete phenolic for Skaneateles Boats, Inc. Boat designed by Sparkman & Stephens. Plexiglas for Doane ship, by Arthur E. Doane.

5

1—You *can* take it with you! This molded-laminated-wood boat weighs only 60 lbs., and therefore can readily be strapped to the top of the car en route to the briny deep. 2—The hull is composed of multiple layers of thin veneers fused together. The skin (foreground) is removed from the die, above. 3—This heating chamber shows the die in position for processing. 4—Comfortable living quarters are provided for 4 persons in the new Speed Ship. Roomy rear deck permits fishing, swimming or aquaplaning. 5—The plastic-plywood seaplane type hull skims over water at high speed. All-around vision is provided by light, shatterproof, sliding windows, which are formed from clear acrylic sheet stock

4



RALEIGH
CHARLOTTE
WILMINGTON
CHARLESTON
SAVANNAH
JACKSONVILLE

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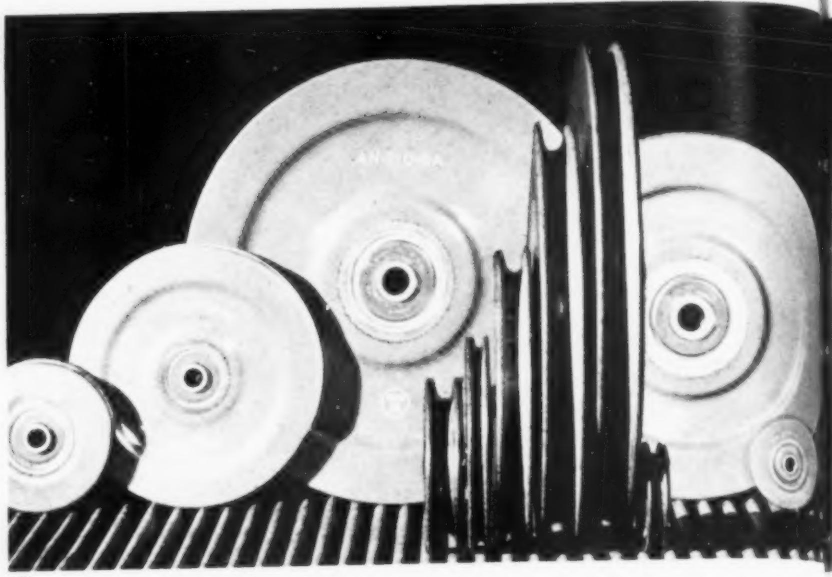

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SEVEN LEAGUE BOOTS
2nd World War Edition
Days of our Years
THE BOOK OF CULTURE

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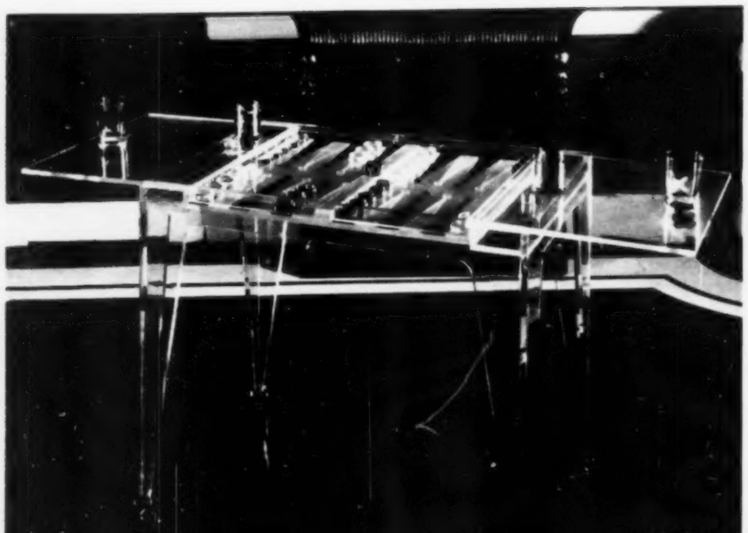

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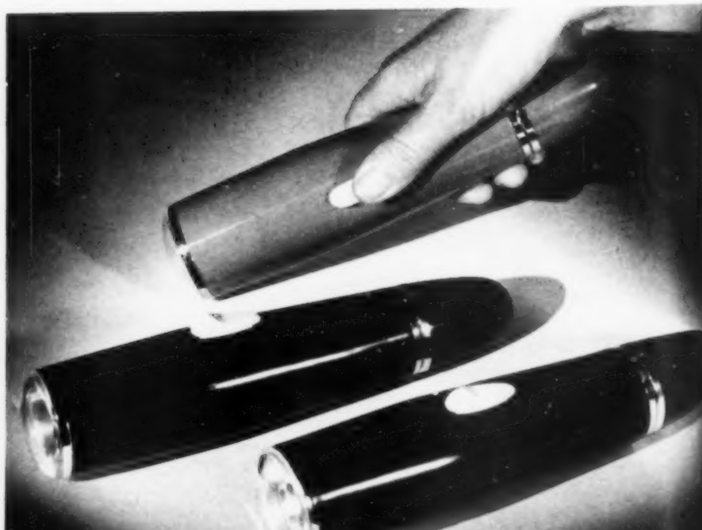

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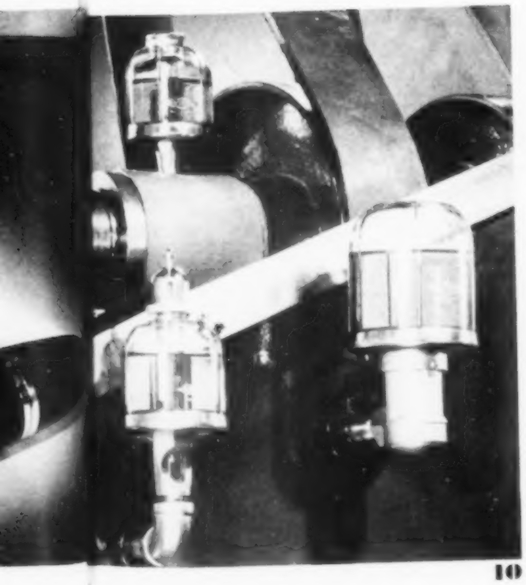

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Plastics in Review

1 An animated map of illuminated colored plastics forms the "visual timetable" in the new Boston ticket office of the Pennsylvania Railroad. Train times and itineraries flash in rotation. Letters are Catalin; route markers Plexiglas, and background, upon which routes are inlaid in the lamination, is Formica

2 With the advent of larger and lighter speed aircraft, come increased control cable loadings which require more easily operated controls. To insure ease of operation with stability, aircraft manufacturers have turned to lightweight laminated plastic pulleys such as these made of Micarta. Various sizes are available and they are made in a graphitized bearing type where friction is of little importance, and also in a high grade antifriction type

3 Good news for M.D.'s is the new model Wappler pocket battery made by American Cystoscope Makers, Inc. This portable physician's battery unit equipped with 4 "Eveready" cells can be used with transilluminators, headlights and other electrical instruments requiring current up to 6 volts. Produced in Bakelite cast phenolics to replace a wooden box, it comes in gray, walnut or brown. It is produced economically with considerable saving in assembly of electrical parts

4 Glistening Lumarith lends itself readily to these smart fall bags. They are made in black in a specially developed formula that is pliable and durable. The patterns are "teardrop," woven and laced, combined with broadcloth, suede and kidskin. Made by Nat Greenbaum Bag Co.

5 Smartly designed, sturdy book-end-pencil holders are of smooth Opalon made by Dolgorukov Mfg. Co. The rich lustrous surface of the plastic is obtainable either in solid color or marbelized effects, with decorations or monograms in gold leaf

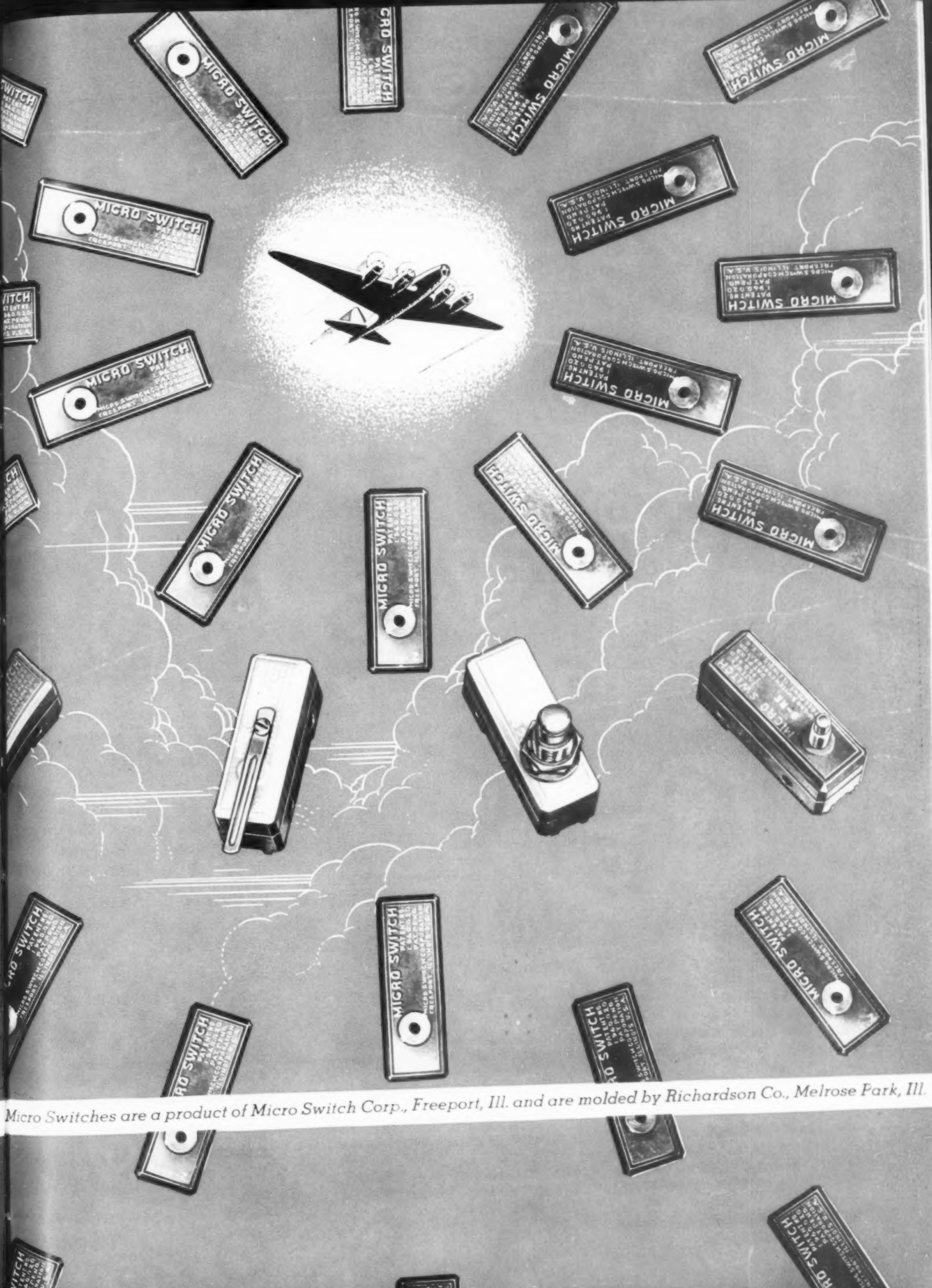
6 New Haven Clock Co. turns to molded plastic housings for some of its new line. This "Tattoo" model has a Durez housing back and front. Ivory enamel is used over the phenolic base. It has a hand-wound alarm which will take plenty of hard usage. Molded by Jos. Stokes Rubber Co.

7 Nylon bristled gun brushes are now available and already doing service. Under recent tests in Outers' Laboratories, manufacturers of gun cleaning equipment, these brushes wore 7 times as long as natural bristles before becoming too gummy for service. Moisture absorption is only about 20 percent that of hog bristle, allowing brushes to retain stiffness after hours of continuous use

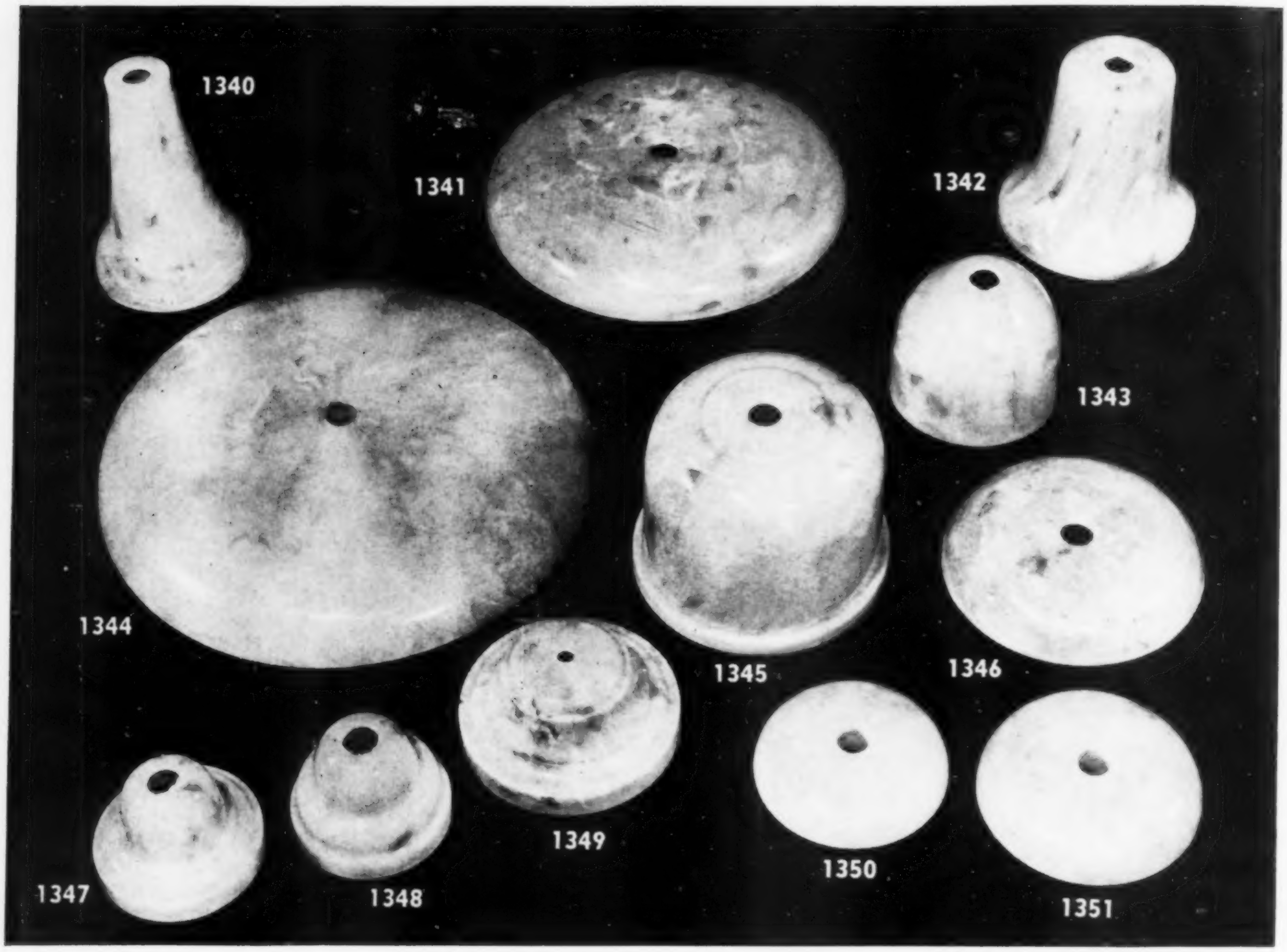
8 Gay and whimsical, a backgammon set by Cora Scovil of Vasah, Inc., serves a twofold purpose. It is the perfect cocktail table when closed and the game we'll over! Plexiglas is used for red counters and markings on the board. Table is clear Lucite

9 Flashlights, streamlined for looks, smooth and light to carry are injection molded in red, blue and black. Plastic shell is reinforced with 9 fins in order to give necessary dimensional stability. There are metal rings at ends of battery chamber and connecting copper strip to which switch is attached. Non-breakable lens is threaded for ease of assembling. Molded by Gits Molding Corp. of Lumarith, based on Hercules cellulose acetate flake, for Montgomery Ward and Company

10 Particularly important for these Trico oil cups was a clear, transparent plastic since the oil in the cup assumes the same color as that in the bearing, indicating when it is time to flush the bearing. Practically unbreakable, cups are said to withstand temperatures up to 270 deg. F. and are easily removed for cleaning and filling. Molded of Tenite II by Elmer E. Mills Corp. for Trico Fuse Co.



Micro Switches are a product of Micro Switch Corp., Freeport, Ill. and are molded by Richardson Co., Melrose Park, Ill.



Stock molds

SHEET ONE HUNDRED-ELEVEN

Simulated onyx lamp parts—bases, vases, caps—are inexpensive and adaptable for many purposes. Available from stock molds without mold cost. Address Stock Mold Department, Modern Plastics, Chanin Bldg., New York, for manufacturers' names and addresses, giving item and sheet numbers

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1340. Cone, 5 in. high; 3 1/2 in. diameter with center opening 9/16 in. in diameter

1341. Round base, 8 in. overall diameter; 5/8 in. center opening; 1 1/4 in. overall depth

1342. Bell-shaped part, 4 1/4 in. overall diameter, 4 in. overall height; center opening 9/16 in. in diameter

1343. Base, 3 1/2 in. overall diameter, 2 3/4 in. high; center opening 9/16 in. diameter

1344. Round base, 10 in. in diameter; 1 1/4 in. high; 9/16 in. diameter center opening

1345. Round base, 5 in. overall diameter; 4 in. overall height; center opening 9/16 in. in diameter

1346. Round base, 5 in. overall diameter; 1 in. overall height; 9/16 in. diameter center opening

1347. Ridged cap, 3 in. overall diameter; 2 in. overall height; 9/16 in. center opening

1348. Cap, three decker, 2 3/4 in. diameter; 2 in. overall height; 9/16 in. center opening

1349. Ridged base, 4 in. overall diameter, 2 in. high; 9/16 in. center opening

1350. Round base, 3 1/2 in. diameter; 3/4 in. high; 9/16 in. diameter center opening

1351. Round base, 4 in. diameter; 3/4 in. high; 9/16 in. center opening

Mechanical tests of cellulose acetate[1]

by WILLIAM M. FINDLEY[2]

THE investigation reported in this paper was undertaken to secure data on the load-resisting properties of plastics, and to study the technique of testing plastics. This involves the consideration of variables such as the effect of small changes in temperature and humidity, the effect of speed of testing, the effect of surface condition, and the effect of attachment of instruments. There has been some work done on the mechanical properties of plastics in which certain of these effects have been taken into account. Two papers[3] along lines similar to that discussed herein have come to the attention of the author.

The material selected for this study (cellulose acetate) would not be considered as a structural material for withstanding high stresses; however, a knowledge of its load-resisting properties is needed in the design of smaller but important parts in which the material does have application. The material was supplied by the Plastics Division of the Monsanto Chemical Co. and is a clear, transparent cellulose acetate (Monsanto formulation number 2050 TV). It is composed of medium viscosity cellulose acetate of the acetone-soluble type, plasticized with about 26 percent of phthalate and aromatic phosphate ester plasticizers. All specimens were cut from one sheet $^3/_{16}$ in. thick which was made by the sheeter process. The finished sheet contains less than 1 percent of residual solvent and water, and the molding temperature was between 200 deg. and 250 deg. F. The Rockwell hardness of the material is about L 40 (at 77 deg. F., 50 percent relative humidity).

Tests and test specimens:

The following tests were made: short-time extensometer tension tests, long-time constant load (time-to-fracture) tension tests, and vibratory bending fatigue tests of notched and unnotched specimens. All specimens were cut on a jig saw from one sheet of cellulose acetate 20 by 50 in. described above. The specimens were cut from the sheet with the same orientation so that the tensile stresses set up during the test were crosswise of the sheet. The final shape of the specimens was obtained by milling and the milled edges were finished with No. 0000 emery paper so as to remove all burrs and all scratches transverse to the direction of tensile stresses. Except as otherwise specified the flat surfaces of the specimens were the original (highly polished) surfaces as they came from the sheeter process.

The specimens were conditioned by allowing them to remain at least four days in a constant temperature and humidity room before being tested. This room, in which all tests were conducted and in which all specimens were stored before testing, was maintained at a constant temperature of 77 ± 1 deg. F. and 50 ± 2 percent relative humidity. All specimens were carefully weighed on an analytical balance before and after testing except for the short-time tension specimens which were weighed only before testing.

Short-time extensometer tension tests

Testing Machine: The tension tests were made on a 1500-lb. Riehle tension testing machine modified to provide pendulum weighing and variable cross-head speed, and equipped with Templin wedge grips. The variable speed was changed by means of V-belt pulleys. It appears likely that the relationship between rate of strain and head speed, and certain characteristics of the stress-strain diagram, such as the upper yield point, may be dependent to a large extent upon the rigidity of the machine. Therefore, the spring constant (the ratio of load to deformation of machine and grips) of this machine was determined and found to be 10,170 lb. per in.—a rather "soft" (non-rigid) machine.

Extensometer: Since it was desired to obtain the complete stress-strain curve to fracture, it was necessary to construct an extensometer having a very long range, having sufficient sensitivity to obtain satisfactory readings in the elastic range, capable of gripping the specimen even with large reductions in cross section, and of withstanding the shock of fracture, and having contacts between the instrument and specimen that would not cause fracture to take place at those points. The instrument, evolved after several trials and modifications, was essentially a parallelogram consisting of two long arms pin-connected to a 2-in. bar at one end with the specimen at the other end. A 1-in. travel dial was placed halfway between the ends of the long arms. The dial was pivoted to one of the arms and the plunger of the dial was fastened by a friction grip to an adjusting

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[1] This paper was presented at the Annual Meeting of the American Society for Testing Materials in Chicago, Ill., on June 24, 1941, and is published here by permission of that society.

[2] Instructor in Theoretical and Applied Mechanics, University of Illinois, Urbana, Ill.

[3] W. F. Bartoe, "Service Temperature Flow Characteristics of Thermoplastics," Mechanical Engineering, Vol. 61, No. 12, December 1939, p. 892; MODERN PLASTICS, Vol. 17, No. 7, March, 1940, p. 47.

Meyer Fishbein, "Physical Properties of Synthetic Resin Materials," Technical Note No. 694, Nat. Advisory Committee for Aeronautics, March 1939.

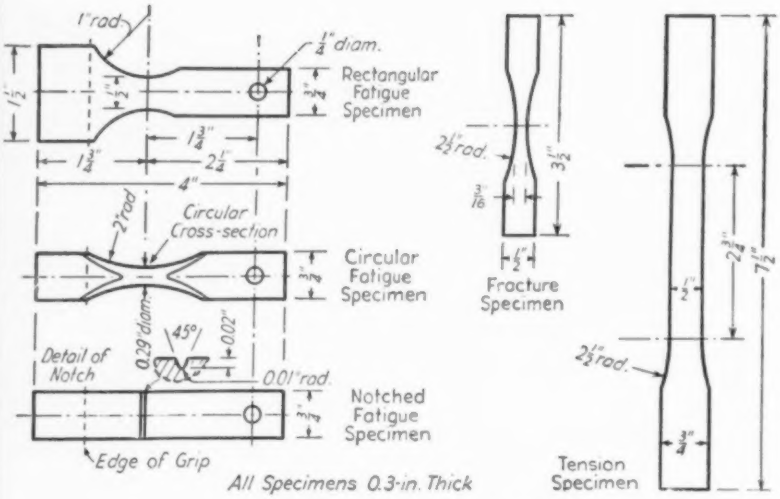
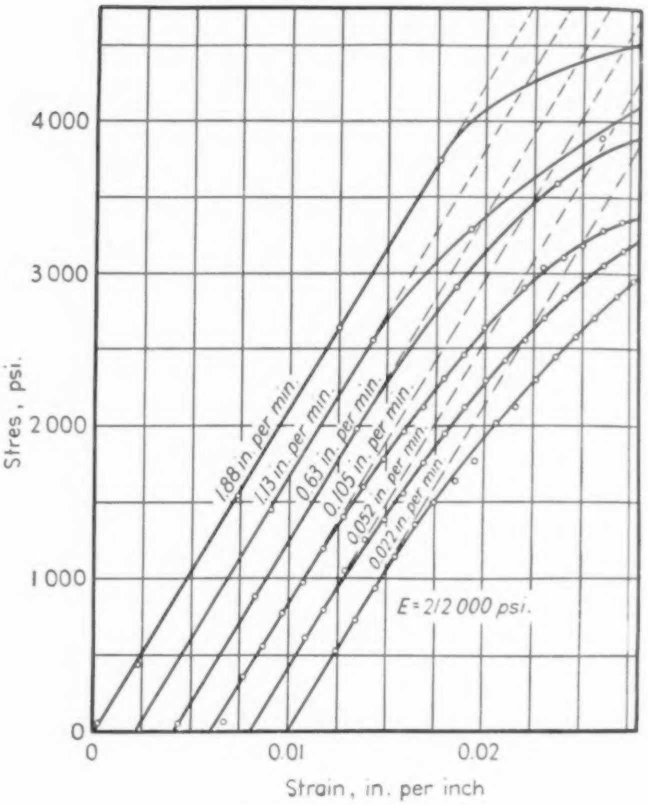


Fig. 1.—Test specimens

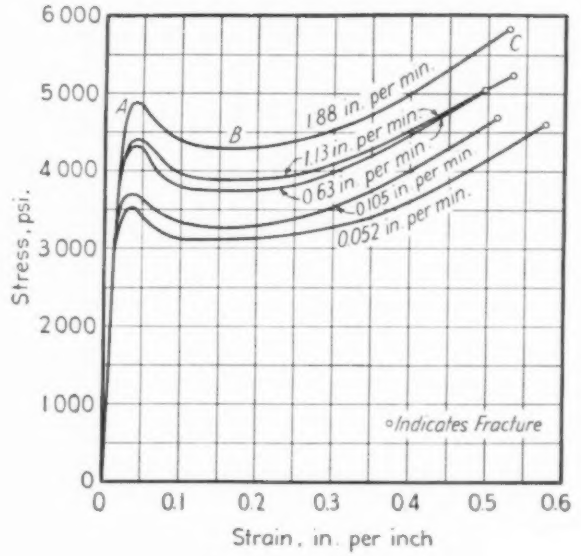
screw which was pivoted to the other arm of the instrument. The friction grip was used so that the dial would not be damaged if the instrument should be extended beyond its normal limits of travel due to the shock of fracture. During a test the free end of the instrument was suspended from the testing machine and the weight of the specimen-end of the instrument was balanced by means of pulleys and counterweights so that relatively small contact pressure between the instrument and the specimen was necessary to keep the two together. It was found that contact points having a radius of about $^1/_{32}$ in. caused enough indentation of the specimen to hold the instrument in place and yet did not cause failure at these marks. The difficulty encountered by the reduction in cross section was overcome by a spring arrangement with sufficient range of motion to automatically keep the contact points pressed against the specimen even for large reduction in cross section.

Procedure: Specimens of the shape shown in Fig. 1 were tested in tension for a variety of different no-load head speeds ranging from 0.022 to 4.5 in. per min. During each of the tests simultaneous readings of load and extension were taken; and for some of the tests simultaneous readings of time were also taken. Readings were taken from the start of the test until fracture and an attempt was made to space the readings in such a way as to permit the plotting of a smooth stress-strain curve. However, at the higher speeds it was difficult to obtain readings in the "elastic" region. Autographic equipment is essential to an accurate record of the "elastic" region for head speeds above 2 in. per min.

From the data obtained in this way, the stresses and strains were computed (the stress was in all cases computed from the original cross-sectional area). Then three sets of curves were plotted: stress versus strain to a scale large enough to show the "elastic" region (Fig. 2 (a)); stress versus strain for the entire curve (Fig. 2 (b)); and strain versus time (Fig. 4). A marked change in the character of the "elastic" region is noticed with increasing head speed. At the lowest speeds—0.022 and 0.052 in. per min.—the stress-strain relation



(a)—Elastic region



(b)—Entire curve

Fig. 2.—The effect of speed of testing on the stress-strain relation in tension.

is a curve almost from the start. At higher speeds this curvature disappears and the relationship becomes nearly a straight line. It will be noticed that the initial slope in all cases is the same (the dash lines are all parallel). It seems probable that the curvature noticed in the tests at low speeds is due to creep which, at the low speeds, takes place at such a rate as to increase materially the strain readings. The fact that the change in the stress-strain relation is from a straight line to a curve rather than simply a change of slope of the straight line

is a verification of the well-known fact that the creep rate increases with the stress. The initial modulus of elasticity was found to be the same for all speeds tested, as may be seen from the dash lines (all of which are parallel) in Fig. 2 (a). The value of the modulus of elasticity obtained from the slope of the dash lines is 212,000 psi. The effect of creep at low speeds makes it difficult to obtain enough points at the initial slope to determine the modulus at head speeds below about 0.5 in. per min. (rate of strain in "elastic" region about 0.05 per min., see below).

The curves shown in Fig. 2 (b) indicate that the material has a definite "yield point" (point A on the curve) and that the general shape of the stress-strain relation is the same for all speeds except perhaps for very slow speeds where creep plays an important part. It is, however, noticeable that the stresses are increased with increasing speed. The exact nature of the effect of head speed upon the tensile properties is more clearly illustrated by Fig. 3 in which are plotted the upper yield point, the lower yield point, the fracture stress, the reduction of area, and the elongation in 2 in. (measured at the instant of fracture) as functions of the no-load head speed of the testing machine. The no-load head speed is used here for convenience. The relation between head speed and the more significant quantity, rate of strain, will be discussed later. The upper yield point is here defined as the stress corresponding to the peak of the curve at the point A; the lower yield point is the stress corresponding to the horizontal portion at point B at which the strain continues without further increase in stress; the fracture stress is the stress at fracture, point C, as computed from the original cross-sectional area; the reduction of area is the final area of cross section expressed as a percentage of the original area; and the elongation is the change in length at time of fracture of an original 2-in. gage length expressed as a percentage of the original.

Figure 3 shows that the upper yield point, lower yield point, and fracture stress all increase with increasing head speed until a critical speed is reached at about 1.5 to 2 in. per min. beyond which they remain substantially constant. An examination of these data will indicate that the values of the lower yield point are more consistent, as shown by less scatter of the data, than either the upper yield point or the fracture stress. This fact becomes more significant in the light of the following remarks: It was noticed during the course of the experiments that very slight transverse surface scratches formed the nucleus from which the final fracture started and that the presence of such imperfections markedly affected the value of the elongation and the stress at which fracture took place. For this reason great care was taken to provide specimens free from scratches. If the specimens had not been very carefully prepared there would have been more scatter in the data for the fracture stress. Further, it has been shown for mild steel that the magnitude of the upper yield point depends upon the rigidity of the testing machine used. While there are as yet no data to prove that this is also true for cellulose acetate, yet it seems likely. In the light of these considerations, the lower yield point would seem to be the more significant tensile property of this material since the lower yield point appears to be the least affected (of the three) by variations in testing conditions. Incidentally, the lower yield point is readily determined at any testing machine speed with any machine in which the load is self-indicating.

Figure 3 also shows the reduction of area and the elongation in 2 in. at fracture plotted against the no-load head speed. It will be noticed that there is considerable scatter of the data. This scatter is perhaps in part due to the fact that the sheet from which the specimens were cut was not of uniform thickness; and since it was desired to leave the original surface on the flat sides of the specimen, this unevenness was not corrected

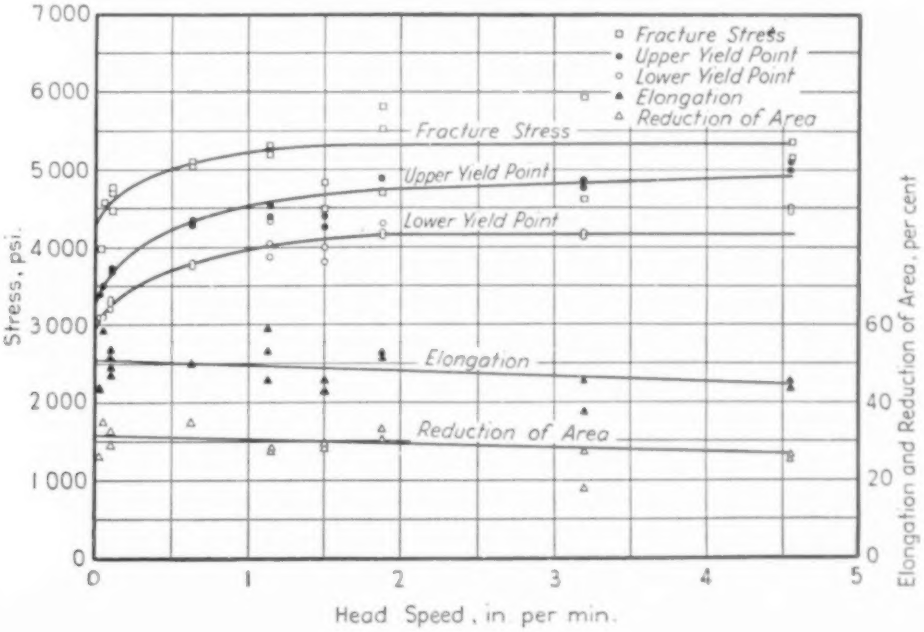


Fig. 3.—The effect of speed of testing on the tensile properties

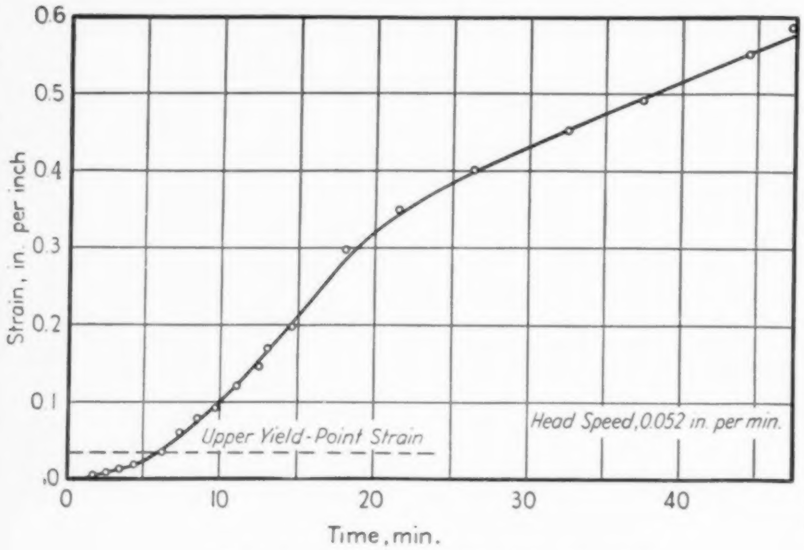


Fig. 4.—Relationship of strain to time during a tension test at different speeds

and might account for some scatter in reduction of area and elongation. However, a large part of the scatter may be attributed to slight surface scratches causing early failure. It will be noticed that there is an indication that both reduction of area and elongation decrease with increasing head speed.

In Fig. 4 is shown a sample curve of strain plotted against time. Such data were obtained from specimens tested at several different head speeds. It will be noticed that there is a distinct change in slope of this curve as the region near the upper yield point is passed. This is due to the fact that up to the upper yield point the load is increasing not only on the specimen but also on the testing machine and hence part of the turning of the screw of the testing machine results in deformation of the testing machine. In a relatively non-rigid machine this may be a large part of the total motion of the screws; hence, the rate of stretching of the specimen is less than that which would occur if the machine were more rigid. But when the lower yield point has been reached the motion of the screw results almost entirely in stretching the specimen because there is no longer any increase in the load on the testing machine and hence the machine does not deform further. Thus in the lower yield point region the rate of straining is much greater than the rate of straining up to the upper yield point. It is evident from this discussion that the variation of rate of strain with time depends to a large extent upon the shape of the stress-strain curve of the material being tested when a machine equipped for constant rate of cross-head motion is used.

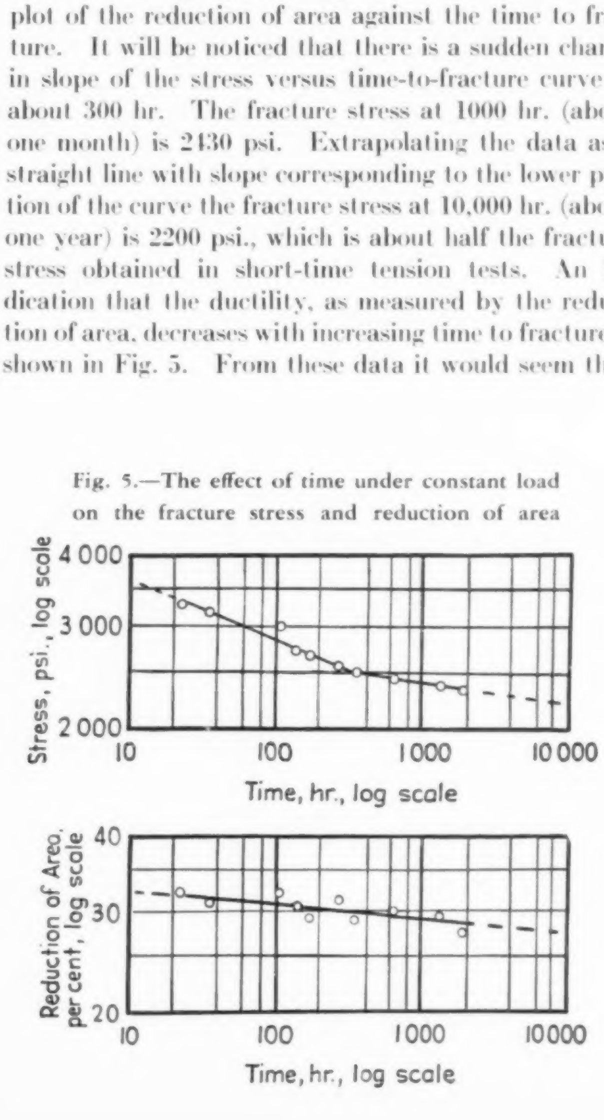
The relationship between rate of strain and no-load head speed for the "elastic" region was obtained from strain versus time curves (similar to the representative curve in Fig. 4) at several different no-load head speeds. This relationship was obtained by plotting the slope of the portion of each curve lying below the upper yield point region against the no-load head speed. A similar study was made of the rate of strain in the region of constant stress. The relationships are: rate of strain in elastic region (per min.) = 0.095 × no-load head speed (in. per min.); rate of strain at constant stress (per min.) = 0.475 × no-load head speed (in. per min.). Hence, by a mere change of scale the abscissa in Fig. 3 would become rate of strain instead of head speed without any alteration in the position of the plotted points.

Fracture under long-continued constant load

The fracture test is used in the study of the behavior of materials that are subject to creep under long-continued steady load. The specimens used in the fracture tests are illustrated in Fig. 1. They were shaped by milling and the milled edges were smoothed with emery paper, but not polished. The apparatus for the tests consisted of a steel rack from which the specimens were suspended and loaded in tension by hanging sufficient weight from the specimen to produce the desired stress. This weight remained hanging on the specimen until the specimen broke at which time the falling of the weight would release a catch to stop a clock and thus record the time of fracture.

Effect of Time on the Fracture Stress and the Ductility: A plot of stress against the time to fracture of cellulose acetate on a log-log scale appears in Fig. 5, and also a plot of the reduction of area against the time to fracture. It will be noticed that there is a sudden change in slope of the stress versus time-to-fracture curve at about 300 hr. The fracture stress at 1000 hr. (about one month) is 2430 psi. Extrapolating the data as a straight line with slope corresponding to the lower portion of the curve the fracture stress at 10,000 hr. (about one year) is 2200 psi., which is about half the fracture stress obtained in short-time tension tests. An indication that the ductility, as measured by the reduction of area, decreases with increasing time to fracture is shown in Fig. 5. From these data it would seem that

Fig. 5.—The effect of time under constant load on the fracture stress and reduction of area



consideration should be given to the decrease in fracture stress with increase in time to fracture when cellulose acetate is to be subjected to continued steady load.

Fatigue

Five sets of fatigue tests of cellulose acetate have been run to determine the effect of the molded surface, the effect of shape of specimen, and the notch sensitivity. A Krouse plate fatigue machine, which is a vibratory type of machine designed to produce the same maximum deflection of the specimen in each cycle, was used. In these tests, the machine was not equipped with variable speed and hence the tests reported were made at a constant rate of 1720 cycles of stress per min. During the first few tests of this series the specimens frequently broke in the grip at either end even though some allowance had been made in the design of the specimen for the stress concentration at the grips. The cause of the difficulty seems to have been a combination of stress concentration and the chafing of the specimen resulting from the minute sliding motion between specimen and grip which occurs at the edge of the grip during the repeated bending. This difficulty was cured by placing a 1/16-in. sheet of rubber gasket between specimen and grips. This type of machine requires that the specimen be calibrated as a cantilever beam to determine the load-deflection relationship from which the deflection necessary to produce the desired stress can be obtained. It is quite noticeable during the calibration that creep occurs as evidenced by increasing deflection under constant load. However, it was found that very satisfactory straight line load deflection curves could be obtained if the calibration was made quickly and the load removed after each reading.

Figure 6 shows the results of the five series of tests. This diagram is a semi-log plot of stress versus number of completely reversed cycles of stress required to cause fracture (the so-called *S-N* diagram).

The specimen used in the first series of tests is shown in Fig. 1. It was of rectangular cross section (width 1/2 in., depth 3/10 in.) in which the original polished surface remained on the flat faces of the specimen and the neutral surface of bending of the specimen was

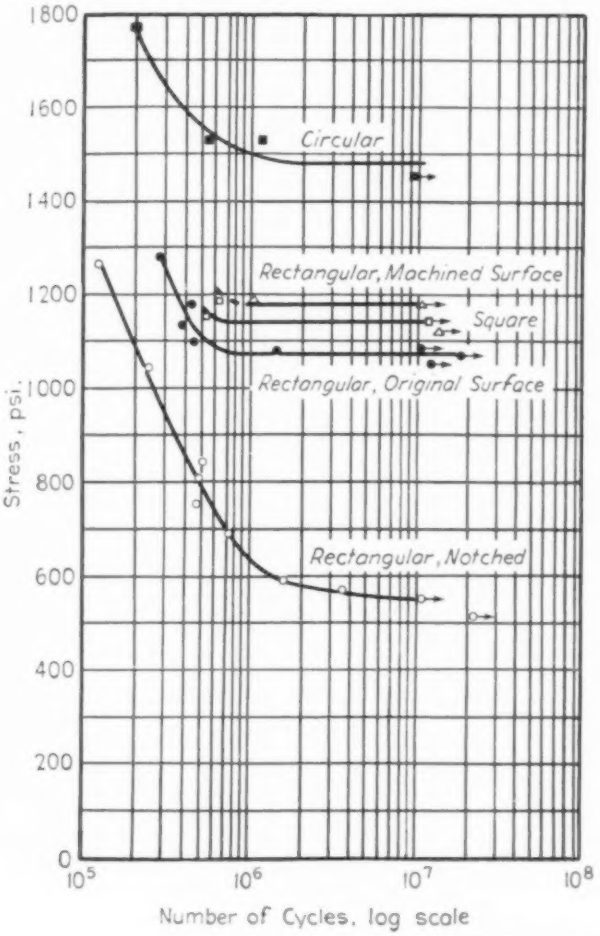


Fig. 6

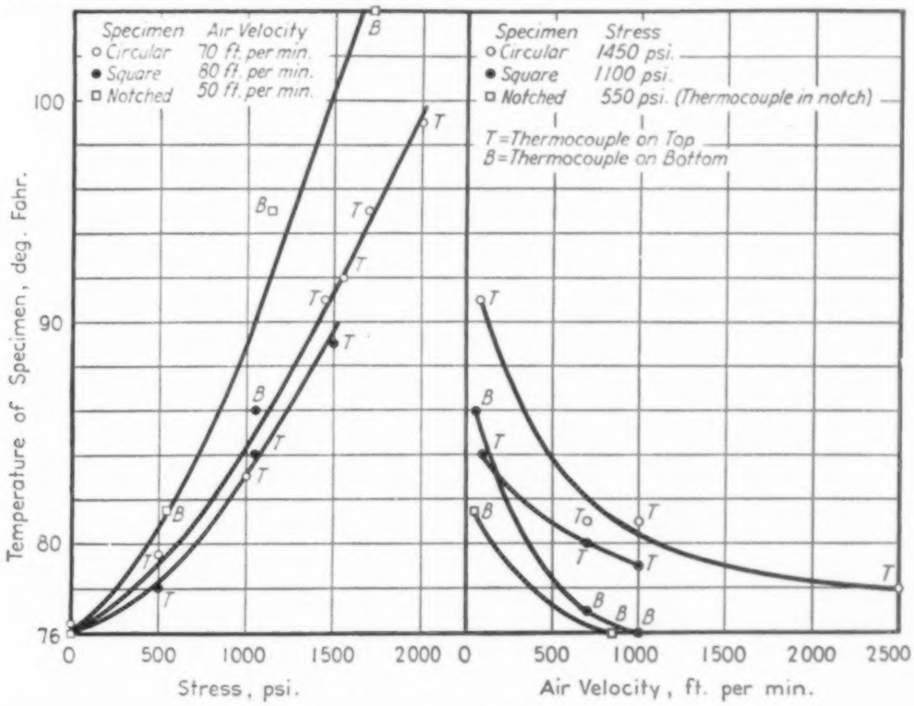


Fig. 7

Fig. 6.—S—N Diagrams
Fig. 7.—The effect of stress and air velocity on specimen temperature in fatigue

parallel to the plane of the figure. This latter was true of all other fatigue specimens shown in Fig. 1. It will be noticed that the *S-N* diagram for this test, and indeed for all other diagrams shown, has a definite sharp break at about one million cycles. This indicates that a "true" endurance limit has been found, that is, a value of completely reversed stress above which fracture of the specimen will occur for a finite number of cycles of stress but below which fracture will not occur for an indefinitely large number of cycles of stress. The value of the endurance limit for this shape specimen was found to be 1075 psi.

Effect of Molded Surface: A second set of specimens was tested having the same general proportions as the first but with the original surface machined off to a depth of 0.025 in. Tests of these specimens under the same conditions as the first group gave an endurance limit of 1180 psi., an increase of 9.8 percent over that of the specimen with the original surface.

Effect of Shape of Specimen: The effect of shape of specimen was investigated in the next two series of tests. In one of these the width of the test section of the specimen was reduced so as to give a square cross section. In this specimen the original surface remained on the specimen. The endurance limit found was 1145 psi., an increase of 6.5 percent over the endurance limit of the rectangular specimen with the original surface. In the other series of tests a specimen of circular cross section as shown in Fig. 1 was used. The endurance limit obtained for this specimen was 1480 psi., an increase of 25.4 percent over the endurance limit of the rectangular specimen with machined surface. The comparison is made with the machined surface specimen because the test section of the circular cross section specimen was also machined. With cellulose acetate, as has been found for other materials, the shape of specimen seems to have a distinct effect upon the endurance limit under repeated stresses.

Notch Sensitivity: The notch sensitivity in flexural fatigue of the material being tested was determined by obtaining an endurance limit of specimens across one face of which a V-notch had been machined as shown in Fig. 1. The endurance limit as computed from the elementary flexure formula using the reduced cross section at the notch was 550 psi., a reduction of 53.4 percent from the endurance limit of the rectangular machined specimen. The effective stress concentration factor for a 60-deg. V-notch (with 0.01-in. radius) in the material being tested was thus found to be 2.15, as obtained from the ratio of the endurance limits of the notched and notch-free specimens. The notched specimen was compared with the rectangular machined specimen because the material which is tested in the notched specimens is that at the root of the notch and hence is equivalent to the material tested in the machined specimen.

Effect of Air Velocity and Stress upon Specimen Temperature: At the conclusion of three of the fatigue tests in which specimens "ran out," the temperature of the high stress portion of the specimen was measured during the operation of the machine by affixing a chromel-alumel thermocouple to that point on the specimen by means of a small strip of cellulose tape. The temperature in each case was found to be above room temperature, which is not surprising when it is recalled that cellulose acetate has rather large damping capacity and hence would absorb considerable energy under repeated stressing. (*Please turn to page 78*)

(a) (b) (c) (d)

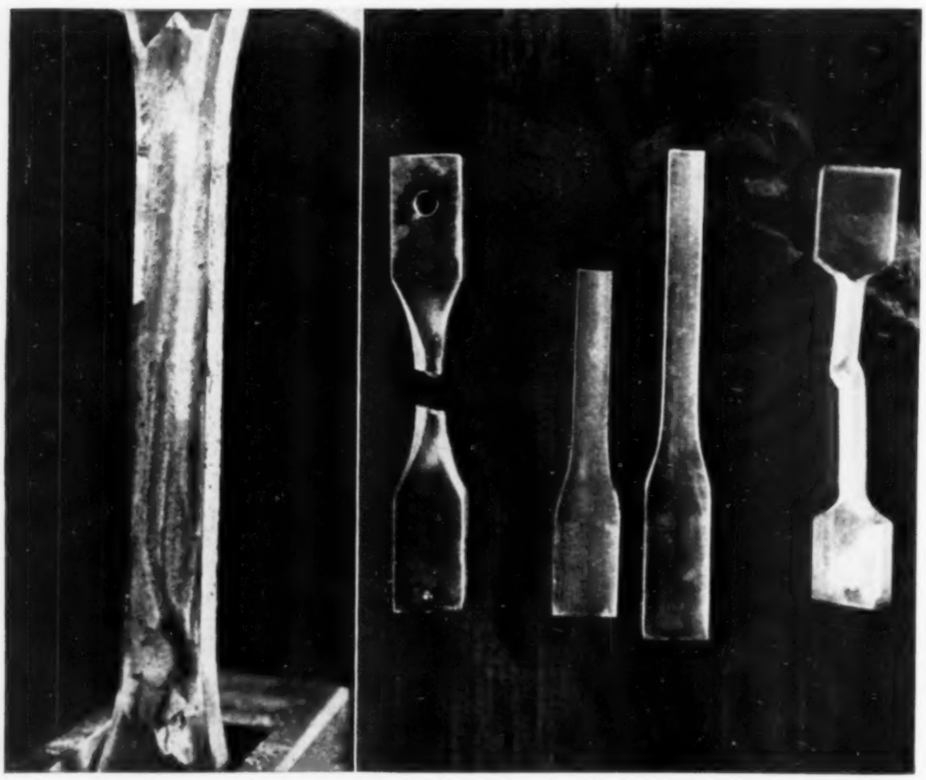


Fig. 8.—Specimens and Fractures
(a) Lime coated tension specimen
(b) Fractured circular cross-section fatigue specimen
(c) Fractured tension specimen
(d) Fractured torsion specimen

Shear strength of molded plastics[1]

by JOHN DELMONTE[2]

THE determination of the shear strength of plastic materials affords a simple and rapid method of comparing an important physical property of these materials. With a standard punch and die as described in this paper, tests are performed in a few seconds, which are quite accurate when performed with the proper load-measuring equipment. It was one of the purposes of this investigation to develop a technique which would enable molders to determine the physical quality of their molded samples on short notice, without the time required for more conventional compression and tension tests. It was also a further purpose of this test to compare the shear strength of injection-molding compositions molded under identical conditions.

The conventional method of testing shear strength of plastics is to place a flat specimen in a universal testing machine between a pair of shear blocks and gradually apply load until failure occurs. This method has much to recommend it for comparison of sheet stocks of plastic materials. However, as far as molded materials are concerned, methods designed to test materials exactly as they are molded, in the same type of mold as they may be used in production, have considerable merit. Not only are the effects of flow, which so decidedly have a bearing upon physical properties, accounted for, but tests are also conducted rapidly, which of course would interest the molder.

Analysis of a punch and die operating upon a plastic material shows that shear stresses are substantially developed upon the stock. The sheared-out specimens, shaped in this test, are perfectly round cylinders.

Equipment used

Determination of the shear strength of the various materials reported in this paper was made with the aid of a circular, hardened steel punch and die which measured 0.106 in. in diameter. The punch was forced through a flat portion of the sample of material being tested, and the loads measured with the aid of a spring loaded scale. The scale was calibrated before tests with dead weight and found to be accurate to within 1 lb. The scale was divided into 1-lb. divisions, measuring up to 250 lb.

In conducting tests, loads were applied at a rate designed to produce failure within 3 to 5 sec. Preliminary investigations using the punch and die showed very little effect of time of loading up to 1 min. on the final reading. Shear strength was estimated from the following formula:

$$\text{Shear Strength} = \frac{\text{Load required to force punch through specimen}}{\mu \times 0.106 \text{ in.} \times t}$$

where t = thickness of specimen where shear occurred.

Calibration of the punch for different thicknesses is represented in Fig. 1, using as a test specimen a $^1/_4$-in. sheet of polymethyl methacrylate sheet. Different thicknesses were milled out of this sheet and the load required to produce failure is shown as a straight-line function of thickness, up to the diameter of the punch.

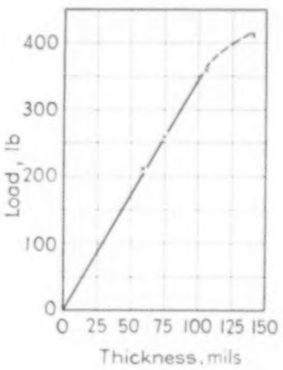


Fig. 1—Calibration test on polymethyl methacrylate Diameter of punch—0.106 in.

The punch and die were hardened, and the punch was rotated in the bearing which served to align it with respect to the die until a smooth fit was obtained by applying a fine lapping compound between the punch and die. Actual measurement on the punch was 0.1053 in., and the die 0.1085 in.

Test results

Various phenolic and urea molding compositions were tested under varying pressures, temperatures and times of cure. Two representative curves are shown in Figs. 2 and 3. For the as-molded condition, samples were tested 24 hrs. after being molded. As would be expected, shear strength continues to increase with time of cure. An even greater differential of shear strength as a function of cure may be performed upon the same specimens after they have been immersed in acetone for a 10-min. period. Tested upon removal, it is found that undercured specimens have suffered a great loss in shear strength, while adequately cured specimens are little affected. All test specimens used in these tests were disks, $1^1/_8$ in. in diameter, produced under conditions as noted on the figures.

In tests upon ureas, the effect of time of cure upon shear strength is emphasized by placing test specimens

[1] This paper was presented at the Annual Meeting of the American Society for Testing Materials in Chicago, Ill., on June 24, 1941, and is published here by permission of that Society.
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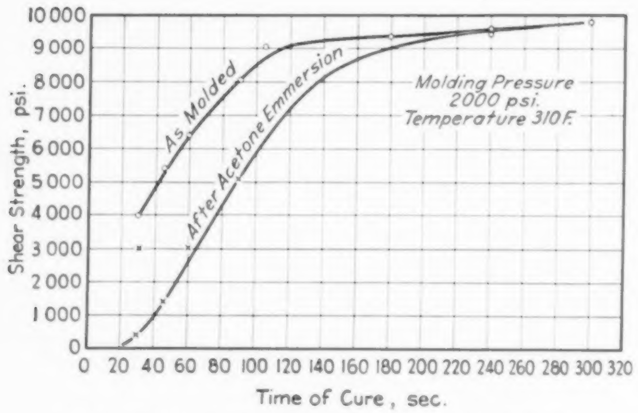


Fig. 2—Shear strength as function of time cure
Phenolic molding material—Durez 1898. Average thickness—0.068 in.)

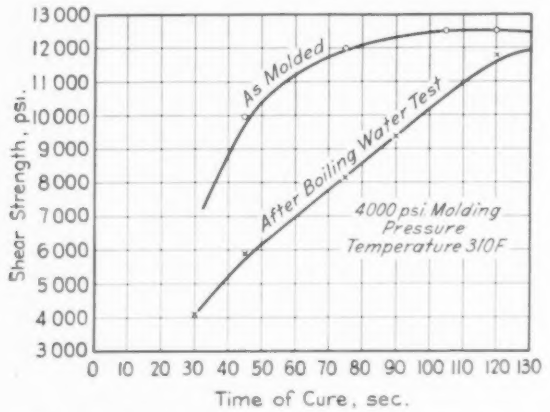


Fig. 3—Shear strength as function of time cure
(Urea molding material—Plaskon 892-SMG)

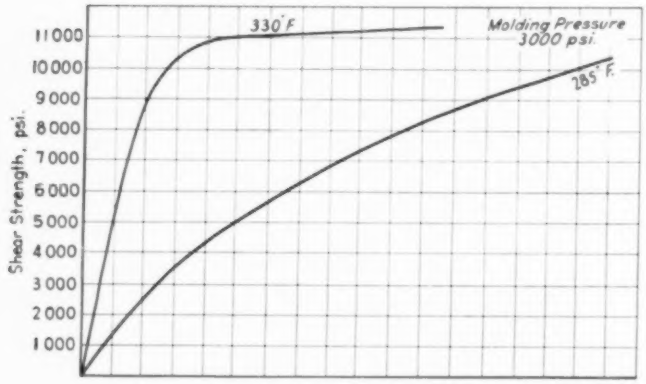


Fig. 4—Shear strength as function of cure at different temperatures
(Urea molding material—Beetle 47W Ivory, SMG)

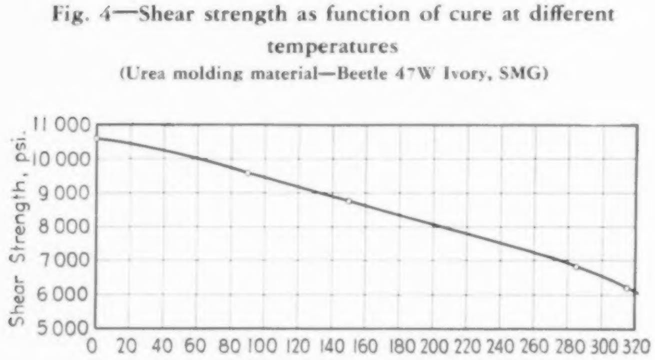


Fig. 5—Shear strength of molded phenolic as function of temperature of test
(Bakelite BM 2498-O-075 in. thickness)

in boiling water for 10 minutes. Very large differences are observed between undercured and properly cured specimens. Similar data were obtained showing the effect of curing time and temperature (Fig. 4).

To demonstrate the versatility of the test method, a shear strength *versus* temperature curve was run from 0 to 315 deg. F. Tests in this instance were performed upon a general purpose phenolic molding material, produced under identical conditions of temperature and pressure during molding. The data are given for this test in Fig. 5. In conducting this test, the punch and die were maintained at exactly the same temperature as the test specimen.

In an effort to determine the effect of degree of flow upon the shear strength of molded thermosetting materials, a mold was designed, Fig. 6, to reproduce test disks after various degrees of flow. The material flows through a restricted opening, $^1/_{16}$ in. in diameter, into a disk approximately 0.1 in. wide and $^3/_4$ in. in diameter. This disk is connected in series through another $^1/_{16}$-in. diameter opening to another disk of the same proportions, and so on, until 5 or 6 disks are stacked parallel to one another. At the proper molding temperature, material was introduced and pressure applied upon the material. The time was noted for the material to stop flowing, and then 1-min. cure was allowed after that point was reached.

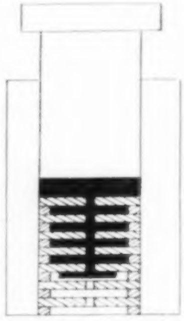


Fig. 6

Results of these tests indicate that there was very little change in the shear strength of successive disks until the last one was reached. (See disks in Fig. 6.) This would indicate that as long as full and proper flow is maintained in molding material during molding, full shear strength may be developed. However, when flow slows up and ceases, as it does in the case of the last disk reproduced, one may expect a substantial reduction in the shear strength. This method has also proved useful in comparing the flow properties of various plastics. Phenolics of good flow properties reproduced four to five disks, while ureas reproduced only one and sometimes part of the second disk. These tests were conducted at 320 deg. F and 3000 psi.

The shear strength of various injection molding compositions was determined under varying conditions of injection pressure and temperature of plasticizing chamber. A flat portion of the piece being molded was selected for test, and all (*Please turn to page 80*)

Preconditioning plastics and electrical insulating materials*

Scope

1. These methods cover procedures for establishing standard periods of time, temperatures, and relative humidities to be used in the pretreatment of plastics and electrical insulating materials prior to testing, as well as in the actual testing of such plastics whose physical properties are subject to rapid change as a result of variations in atmospheric conditions. The methods are intended to be applicable to plastics and electrical insulating materials, except when other methods of conditioning are definitely prescribed in the individual methods of test or in the specifications for a particular material.

Classification of materials for preconditioning

2. (*a*) Materials to be tested shall be arbitrarily classified as type S (slow) or as type R (rapid) on the basis of the rapidity with which their physical properties vary with changes in atmospheric humidity at 25 deg. C. (77 deg. F.).

(*b*) In order to classify materials for preconditioning and conditions for testing, specimens shall be subjected to the procedure for type S materials as described in Section 4 (*a*). The humidity change shall consist of removing the material from the anhydrous calcium chloride desiccator and keeping it at a relative humidity of 50 percent for 15 min. ± 15 sec. In establishing the classification, impact tests on the material shall be made within 15 sec. after removal from the desiccator used in the type S procedure, and a similar test shall be made within 15 min. ± 15 sec. after removal from the desiccator. During this 15-min. period, the material shall be kept in an atmosphere of 50 percent relative humidity.

(*c*) Any material which, during the period of time prescribed for the completion of the test made in accordance with Paragraph (*b*), changes sufficiently in mechanical properties to affect the numerical results of the impact test by 10 percent or more as a result of changes in humidity shall be classified as type R materials. Materials which show less than 10 percent change shall be classified as type S materials.

Note.—While some properties are practically unaffected by changes in atmospheric humidity, the physical properties of most cellulose derivatives and some polyvinyl acetal resins are sufficiently affected by humidity to establish them in the type R classification. Plastics manufactured from methyl methacrylate, phenol-formaldehyde, or urea-formaldehyde are so slowly affected by atmospheric changes that they would be included in the type S classification.

Apparatus

3. The apparatus shall consist of the following:

(*a*) *Type S Materials.*—A circulating air oven maintained at a temperature of 50 ± 3 deg. C. (122 ± 5.4 deg. F.), and suitable desiccators containing anhydrous calcium chloride. The desiccant shall be renewed frequently.

(*b*) *Type R Materials.*—A room, of sufficient size for conducting the desired tests, maintained at a temperature of 25 ± 1 deg. C. (77 ± 2 deg. F.) and at a relative humidity of 50 ± 2 percent.

Procedure

4. (*a*) *Type S Materials.*—Type S specimens shall be preconditioned for a period of 48 hr. in the circulating air oven at a temperature of 50 ± 3 deg. C. (122 ± 5.4 deg. F.). The specimens shall be removed from the oven, cooled in the desiccator over anhydrous calcium chloride for a period of at least 16 hr. prior to actual testing. A definite time interval, previously decided upon by the cooperating laboratories, shall be allowed to elapse between the removal of the specimens from the desiccator and the application of the tests. The tests may be made at room atmospheric conditions.

If type S materials are distorted or otherwise affected by the type S conditioning procedure, they may be conditioned and tested in accordance with the procedure for type R materials. If the specimens are over 0.25 in. in thickness or if they may previously have been subjected to excessive humidity, or both, the time of conditioning shall be extended to 96 hours.

(*b*) *Type R Materials.*—Type R specimens shall be preconditioned for 48 hr. in a room at a relative humidity of 50 ± 2 percent at 25 ± 1 deg. C. (77 ± 2 deg. F.) prior to actual testing. The tests shall be made in the same room and under the same atmospheric conditions at which the specimens were preconditioned. If, because of lack of equipment, type R materials are tested in accordance with the type S procedure after conditioning in accordance with the R procedure, the effect of the time elapsing between the removal from the desiccator and the actual start of the tests shall be established.

Report

5. The report shall clearly state the type of preconditioning used and the atmospheric conditions under which the tests were made.

* The above proposed tentative methods of preconditioning plastics and electrical insulating materials (A.S.T.M. designation D618-41T) are published here by permission of the American Society for Testing Materials.

Plastics digest

This digest includes each month the more important articles of interest to those who make or use plastics. Mail requests for periodicals mentioned directly to individual publishers

General

SYNTHETIC RUBBER AND PLASTICS. Harry Barron. British Plastics *12*, 276–8 (Feb.); 329–30 (Mar.); 350–2 (Apr.); *13*, 24–8 (June 1941). Synthetic rubbers are closely allied to plastics. Monomers used in producing plastics must be added to butadiene to produce commercially satisfactory products. Rubber, itself, is the parent material for many thermoplastics, for example, chlorinated rubber, rubber hydrochloride and cyclized rubber. Petroleum is a source of ethylene, isobutylene and butadiene for conversion into plastic products. Full-scale operations in deriving products from petroleum for synthetic rubber manufacture will profoundly influence developments in synthetic resins.

PLASTICS IN THE ELECTRICAL INDUSTRY. G. E. Haefely. Chem. and Ind. *60*, 532–7 (July 19, 1941). The role of phenolic plastics of the laminated and wound types in the production of high tension apparatus is described. The fully plastic-minded investigator can foresee the time when insulators now made of laminated plastics will be truly molded from pure resin, regardless of size, and with metallic condenser layers included, if required. The mechanical and thermal properties of such a plastic, apart from the electrical characteristics, must be at least equally as good as those of the present product—a handy reference book.

WHY RESIN FINISHES ARE GROWING IN IMPORTANCE. Alden D. Nute. Am. Dyestuff Rep. *30*, P417–20 (Aug. 4, 1941). Consumer opinion and demand for something better is playing an important part in the growth of the use of resins for fabric finishes. Color fastness, control of shrinkage, crease resistance, and permanently improved feel, drape and "hand" of inexpensive cotton and rayon fabrics are factors forcing fundamental changes in the character of salable textiles. The ideal finishing resin should be stable in storage, soluble in cold or warm water, and free from dermatitic action; it must not affect light fastness of colors, tensile strength and abrasion resistance adversely; it must not retain chlorine from bleach liquors or leave a disagreeable odor in the goods; printed or dyed color shades should not be affected; it should cure quickly at 220° to 250° F. and be permanent to laundering, retaining "hand" as well as resin content; it should be economical in both material and application costs.

Molding and Fabricating

COMPRESSION OR INJECTION MOLDING FOR THERMOSETTING MATERIALS? A. Amigo. British Plastics *13*, 39–42 (July 1941). On the basis of comparisons of press and mold costs, time factor, material costs and finishing operations, the author finds that the choice between the two methods of molding will depend on the size and complexity of the part and the volume required.

BASIC FACTORS IN INJECTION MOLD DESIGN. W. R. Wheeler. Machinery *47*, 103–10 (June 1941). Design of sprues, runners, gates, cavities, vents, knockout assemblies, mold shoes and mountings, and problems involved in molding thin-walled and heavy sectional castings, respectively, are discussed.

IMPROVED EJECTOR PINS FOR MOLDS. British Plastics *12*, 392, 394 (May 1941). Improvements in design and attachment of ejector pins are described and illustrated.

Applications

ELECTRICAL INSULATING MATERIALS. G. E. Haefely. J. Inst. Elec. Eng. *88*, pt. 1, 179–88 (May 1941). A review of progress in dielectrics during the period 1931 to 1941. Natural mineral insulations, vitrified insulations, molded composite insulations, sheet, rod, and tube insulations, varnishes, insulating oils, and treated sheet insulators and sleevings are considered.

VINYON NOW ENTERING VARIED FILTER APPLICATIONS. W. G. Luttge. Chem. and Met. Eng. *48*, 98 (June 1941). Vinyon, a vinyl copolymer yarn, is now available in various types of filter cloths characterized by resistance to acids and alkalies. Considerable success has been experienced in the use of these cloths for removing solid particles from concentrated sodium hydroxide solutions, in the filtration of finely divided particles from strong sulfuric acid solution in the production of titanium dioxide, and in handling clays under highly acid conditions. Among acid-resisting applications other than in filter cloths, this resinous fiber is being used effectively in the form of anode bags in electrolytic operations. These fabrics are also entering into the field of chemical resistant clothing for workmen, with experiments now being conducted by several chemical firms with gloves, jackets and cover-alls of this material which should prove interesting.

ANTI-SCATTER TREATMENTS FOR WINDOWS. H. M. Llewellyn. Chem. and Ind. (London) *60*, 433–4 (June 7, 1941). A summary of methods of testing and materials tested by the Building Research Station to afford protection from hazardous glass splinters during bomb explosions is presented. Transparent film, paper and fabric stuck to the glass, and liquid treatments involving rubber latex and synthetic resin lacquers were investigated. To obtain approval a treatment must prove capable of remaining effective for at least 4 months when applied to the indoor side of the window.

RECENT DEVELOPMENTS AT SHAWINIGAN CHEMICALS, LTD. G. O. Morrison Chem. and Ind. (London) *60*, 387–92 (May 24, 1941). Vinyl resins are among the important products derived from acetylene, produced from the basic product of the plant, calcium carbide. Polyvinyl acetates (Gelvas) are used as lacquers, adhesives, impregnating agents and as a base for chewing gum. Polyvinyl alcohols (Solvars) go into adhesives, coating materials and emulsifying agents. Polyvinyl formals (Formvars) are used in molding compounds, wire coatings and in impregnating compounds. Polyvinyl acetals (Alvars) find outlets in lacquers, adhesives molding compounds and phonograph records. The most important use of the polyvinyl butyrals (Butvars) is as the interlayer in laminated glass. Recommendations are listed for plasticizers to be used with these various resins.

THE STRUCTURE OF SYNTHETIC FIBERS. Malcolm Dole. Am. Dyestuff Reporter *30*, P327–336 (June 23, 1941). Chemical historians will probably list among the most important discoveries of the decade 1930–1940 the invention and development of synthetic fibers, fibers which were completely synthesized from simple basic chemicals. Although the earlier fibers made of regenerated cellulose, cellulose acetate and mercerized cotton are synthetic fibers according to the definition of these as "any solid in which a preferred orientation of the structural units has been induced by mechanical means," nevertheless, they were constructed of raw materials already possessing a fibrous structure, such as wood pulp and cotton. Published information on the structure and properties of commercially available synthetic fibers is reviewed in considerable detail in this article.

Ewing Galloway

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

RUBBER HYDROCHLORIDE. J. B. Holden (to Wingfoot Corp.). U. S. 2,248,025, July 1. A plastic composition of rubber hydrochloride pigmented with lead chromate.

PLASTIC POLYMER. H. W. Fisher (to Standard Oil Development Co.). U. S. 2,248,071, July 8. Making rigid shaped articles of polyisobutylene pigmented with carbon black for reinforcement and for stabilization to light.

CORK COMPOSITION. Orville V. McGrew. U. S. 2,248,-105, July 8. A plastic composition of cork particles coated with a permanently flexible binder which permits free compression and expansion.

DIPPED ARTICLES. Benj. Schachter. U. S. 2,248,253, July 8. Making cellulose dipped articles by placing forms coated with cellulose solution in a closed space so that solvent vapor accumulates around the forms, and revolving the forms while withdrawing the vapor in successive steps.

POLYSTYRENE. T. B. Philip, H. M. Stanley and W. L. Wood (to Distillers Co. Ltd.). U. S. 2,248,512, July 8. Depolymerizing polystyrene by flash heating to 550–700 deg. C.

PAPER BOTTLES. G. Meyer-Jagenberg and A. C. Plötze. U. S. 2,248,534, July 8. Coating the inside of paper bottles with an emulsion of an olefin polymer in water.

PROTEIN COMPOSITION. P. L. Julian and E. B. Oberg (to Glidden Co.). U. S. 2,249,003, July 15. Dispersing a protein in molten urea and treating the product with formaldehyde.

THERMOPLASTIC TUBES. D. and J. Kahn (to David Kahn, Inc.). U. S. 2,249,004, July 15. Continuously drawing thermoplastic tubing by seating the tubing on a mandrel and softening it by heat while drawing it through a die.

ELECTRIC INSULATION. A. J. Hanley (to Respro, Inc.). U. S. 2,249,275, July 15. Plastic flat sheets of insulating material are formed by surface sizing an open fluffy asbestos fiber wadding, impregnating it throughout with a synthetic resin and forming it into a plastic sheet.

ABRASIVE SHAPES. S. S. Kistler (to Norton Co.). U. S. 2,249,278–9, July 15. Bonding abrasive grains with a dehydrated infusible phenolaldehyde resin in presence of an inorganic dehydrating agent so that no uncombined water is present.

INSULATED WIRE. Wm. Koch (to Hercules Powder Co.). U. S. 2,249,280, July 15. Insulating wire with fused ethylcellulose containing 5 to 25 percent of mineral oil to impart high cold flexibility.

CONTAINER. G. A. Moore (to Humoco Corp.). U. S. 2,249,392, July 15. Cementing metal foil to a fibrous web, waxing the fibrous surface, coating the foil with a thermoplastic adhesive and forming a container from the blank under heat and pressure.

ELECTRICAL INSULATION. E. T. Croasdale (to General Electric Co.). U. S. 2,249,458, July 15. Flexible insulation with low power factor and low specific inductive capacity at normal and radio frequencies is made of rubber compounded with not over 40 percent of polystyrene.

OIL-SOLUBLE RESIN. G. F. D'Alelio (to General Electric Co.). U. S. 2,249,460, July 15. Resinifying *p*-phenylolphenylethane by condensation with formaldehyde in presence of oxalic acid.

VARNISH. W. Schulze (to General Electric Co.). U. S. 2,249,498, July 15. Heating an acrylate polymer in presence of an organic peroxide and dissolving the product in a solvent.

CASTING FOILS. H. E. Van Derhoef (to Eastman Kodak Co.). U. S. 2,249,507, July 15. A machine for casting foils from a film-forming solution on a moving support.

PLASTICIZERS. J. B. Dickey and J. G. McNally (to Eastman Kodak Co.). U. S. 2,249,518, July 15. Plasticizing cellulose esters or ethers with 15 to 80 percent of a morpholine ester containing one or two morpholine radicals.

ACETYLENIC ACID RESIN. A. D. Macallum (to E. I. du Pont de Nemours and Co.). U. S. 2,249,535, July 15. Making a resin by condensing propiolic acid with a polyhydric alcohol.

REVERSIBLE GELS. W. H. McDowell and W. O. Kenyon (to Eastman Kodak Co.). U. S. 2,249,536–7–8, July 15. Making firm heat-reversible gels of polyvinyl alcohol by compounding the polymer with a polyhydric phenol, 1-naphthol or a dihydroxynaphthalene; or with a metal salt of a hydroxybenzamide; or with orcinol, chlororesorcinol, gallic acid or a substituted naphthol.

DEXTRAN RESIN. G. L. Stahly and W. W. Carlson (to Commonwealth Engineering Corp.). U. S. 2,249,544, July 15. Making resinous mixed benzyl butyl ethers of dextran.

TRANSPARENT FOILS. D. R. Swan (to Eastman Kodak Co.). U. S. 2,249,545, July 15. Forming rubbery acetal resin foils by adding a blend of dibutyl sulphone and dibutyl phthalate as an elasticizer.

LINEAR POLYMER. H. B. Dykstra (to E. I. du Pont de Nemours and Co.). U. S. 2,249,686, July 15. Compounding linear polyamides with 1 percent or more of rubber, gutta percha, balata, synthetic rubber or polyisobutylene.

FLASHLIGHT. Albert Gelardin. U. S. 2,249,692, July 15. A pocket flashlight has a casing molded from insulating material.

MOLDABLE PLASTIC. M. C. Dodge (to Columbian Rope Co.). U. S. 2,249,888, July 22. Making a plastic from a thermosetting binder and a filler of long vegetable fibers having interlocking tufts of fiber.

(Please turn to page 90)

Foreign plastics patents

Application dates are given for patents of European countries, but for Canada the issue date is given

POLYVINYL ACETALS. G. O. Morrison and A. F. Price (to Shawinigan Chemicals Ltd.). Canadian Patent 395,343–4; 395,373, March 18, 1941. Making colorless vinyl acetal resins by action of acetaldehyde on partially hydrolyzed polyvinyl acetate in acid aqueous medium, e.g., in solution in acetic acid with sulphuric acid as catalyst.

TRANSMISSION BELT FACING. H. Berg and B. von Zychlinski (to Chemische Forschungsgesellschaft). Canadian Patent 395,377, March 18, 1941. Power transmission belts are faced with a layer of partially etherified, esterified or acetalized polyvinyl alcohol for high coefficient of friction and resistance to accumulation of static charges.

WOOD TAR RESIN. Jean J. Levesque. Canadian Patent 395,562, April 1, 1941. Making resins by condensing a wood tar distillate with formaldehyde.

PLASTERBOARD. V. Lefebure (to Imperial Chemical Industries Ltd.). Canadian Patent 395,857, April 15, 1941. Plasterboard is allowed to set while faced on one or both sides with a fibrous liner impregnated with a thiourea or urea resin, which is cured by heat during the final drying.

GASKETS. K. Michel (to the firm Paul Lechler). Canadian Patent 395,914, April 15, 1941. Impregnating metal wool with a thermosetting phenolic resin and molding gaskets from the product.

SHRINK CAP. B. von Zychlinski (to Dr. Alexander Wacker Ges. für elektrochemische Industrie). Canadian Patent 395,923, April 15. Heating a polyvinyl acetal resin foil, stretching, applying the foil as a bottle cap and allowing it to shrink in place.

MOLDED ELECTRIC BRUSHES. Jas. R. Tate and Ralph L. Henry. Canadian Patent 395,933, April 22, 1941. Light, porous electric brushes are molded from graphite, a thermosetting synthetic resin binder and boric acid which forms pores by losing water when heated.

POLYSTYRENE. H. M. Stanley, G. Minkoff and J. E. Youell (to Distillers Co. Ltd.). Canadian Patent 396,188, April 29, 1941. Polymerizing styrene in presence of a small proportion of divinylbenzene to form a soluble resin.

POLYSTYRENE. Herbert M. Stanley and Hanns P. Staudinger. Canadian Patent 396,278, April 29, 1941. Polymerizing styrene in presence of an alkyl (hexyl to dodecyl) crotonate.

PLYWOOD. Jas. V. Nevin. Canadian Patent 396,465, May 13, 1941. Making 3-ply weatherproof, vermin-resisting board for outdoor sidings by bonding veneer sheets together with a cresylic acid-formaldehyde resin.

COLLAR STIFFENER. Thos. L. Shepherd. Canadian Patent 396,596, May 20, 1941. A launderable multiply fabric article is stiffened with a preformed interliner made of a cellulose derivative or a synthetic resin, permanently bonded to the fabric under heat and pressure.

AIRCRAFT FINISH. Herbig-Haarhaus A.-G. Lackfabrik. Holland Patent Application 93,289, Dec. 16, 1940. Dissolving after-chlorinated vinyl chloride resin in a solvent:nonsolvent blend, containing 40–90 percent as much nonsolvent as solvent.

VINYL RESIN SOLVENT. I. G. Farb. Akt. Holland Patent Application 94,097, Dec. 16, 1940. Using tetrahydrofuran, alone or blended with other solvents or swelling agents, as a vehicle for highly after-chlorinated vinyl chloride resin (over 65 percent chlorine).

ETHYLENE POLYMERS. Imperial Chemical Industries, Ltd. Holland Patent Application 87,387, Jan. 15, 1941. Making films, foils, filaments or sheets from interpolymers made by polymerizing ethylene with an acrylate or methacrylate ester, butadiene, divinylbenzene, styrene, stilbene or a vinyl ester.

WRAPPING FOILS. Sylvania Industrial Corp. Holland Patent Application 89,219, Jan. 15, 1941. Moistureproof, greaseproof foils are made by coating a cellulosic foil with a cellulose derivative lacquer containing as plasticizer a reaction product of a fatty acid and a benzophenone-carboxylic acid.

THREADING MOLDED PARTS. Alfred Bender (to Bender und Wirth). German Patent 698,511, Feb. 28, 1938. An improved method of forming threaded ends on molded parts in a mold which is divided axially.

PURIFYING VINYL COMPOUNDS. Röhm und Haas G. m. b. H. German Patent 698,643, April 29, 1936. Compounds containing the vinyl group (vinyl acetate, styrene, acrylonitrile, acrylate esters and methacrylate esters) are purified by fractional distillation in presence of a high-boiling liquid such as phenol.

PURIFYING COUMARONE RESIN. Anton Weidel. German Patent 698,855, Oct. 27, 1938. Refining crude coumarone resins by heating in an atmosphere of nonoxidizing gas, such as illuminating gas, to expel volatile impurities.

SYNTHETIC RESIN. Bakelite Gesellschaft m. b. H. German Patent 697,222, May 15, 1935. Making a resin by heating a chloride of an aromatic dibasic acid with an ester of an aromatic hydroxy acid at 225–250 deg. until evolution of hydrogen chloride ceases.

SEALING COMPOSITION. Ferdinand E. Stuhnicki. Swiss Patent 206,461, Nov. 16, 1939. Compounding chlorinated rubber with castor oil, lanolin and absorbents or adsorbents for toxic gases to make a plastic seal for protection against war gases.

MOLDINGS. Société pour l'industrie chimique à Bâle. Swiss Patent 207,518, Feb. 16, 1940. Making clear transparent light-fast molded articles from resins formed by condensing an aminotriazine with formaldehyde and an alcohol.

VINYL POLYMERS. Dr. Alexander Wacker Ges. für elektrochemische Industrie. British Patent 514,116, Oct. 31, 1939. Vinyl chloride is purified with strong aqueous alkali, then polymerized (or interpolymerized with other polymerizable compounds) in such a way as to yield a very high polymer.

Publications

Write direct to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent postpaid at the publishers' advertised prices

Engineering Encyclopedia

Published by The Industrial Press, 140 Lafayette St., New York, 1941.

Price $8.00, Two volumes, 6 by 9 in., 1431 pages; 206 illustrations

These 2 volumes supply, in condensed form, the essential facts about 4500 standard and special engineering subjects. Although intended primarily for reference purposes, the Encyclopedia is designed to give students, whether young or old, a broad fund of knowledge relating to the outstanding subjects in many different branches of engineering. Because of the scope and miscellaneous character of this two-volume work, it is, of course, impossible to describe adequately the contents. In general, it consists of concise treatises ranging from short paragraphs to several pages in length. These deal with various important mechanical laws, rules and principles; physical properties and compositions of a large variety of materials used in engineering practice; the characteristic features and functions of different types of machine tools and other classes of manufacturing equipment. These condensed treatises are accompanied by definitions of numerous trade and technical terms used in engineering and manufacturing practice—a valuable reference to those in the field.

Strategy in Selling

By J. C. Aspley

Published by the Dartnell Corp., 4660 Ravenswood Ave., Chicago, Ill., 1941.

Price $6.00, 7 pocket-size manuals, 60 pp. ea.

A series of 7 pocket-size manuals dealing with the advancement of American standards of salesmanship constitute a complete streamlined pocket sales course. Each book measures only $4^1/_2$ in. by 8 in., a convenient size for the salesman to carry about. The titles of the books are: Planning the Sale, Getting Better Interviews, Making the Presentation, Disposing of Objections, Closing the Sale, Managing Your Time, and the Way to Leadership. A series of self-checking questions is included in the back of each book so that the reader can quickly and easily check his grasp of the selling strategies explained in the text. The discourses are written in an easy and readable style.

★ A NEW 8-PAGE BROCHURE DESCRIBING COMpletely the various flexible shaft machines available for defense industries has been issued by the Walker-Turner Co., Inc., Plainfied, New Jersey.

Equipment for use in grinding, polishing, burring and for a host of other operations necessary in the manufacture of airplanes, airplane engines and parts, marine engines and accessories, in the automotive field, in general machine shops, foundries and die shops are described in detail.

Machines illustrated range from heavy duty models to commercial and intermittent duty types, and include bench and floor models, and suspended models in direct drive, multi-speed drive and two-speed geared drive.

★ A GENERAL CATALOG ILLUSTRATING VARIOUS items of manufacture has been issued by Armstrong-Blum Mfg. Co., 5700 West Bloomingdale Ave., Chicago, on its Marvel products. These include hack saw machines, automatic production saws, metal band saw machines, hack saw blades, band saw blades, tapping machines, drill press vises, slitting shears and rod cutters. The catalog is well illustrated and bound loose-leaf fashion so that sheets may be taken out for study.

★ SYNTHANE CORP., OAKS, PA., MANUFACTURERS of Synthane Bakelite-laminated, have prepared a new folder of their Silent Stabilized Gear Materials. The folder describes the principal properties of the grades most used for gears, and the uses and advantages of the material. For ease and speed in calculating the horsepower transmissible by laminated gears there are six convenient new charts for gears of 2, 4, 6, 8, 12 and 18 pitch. Each chart shows the horsepower per inch of face at pitch line velocities for gears of 12, 16, 25, 38, 50 and 60 teeth.

★ DIEMOLDING CORP., CANASTOTA, N. J., HAVE issued a folder, "Stock Valve Handles," which gives a complete description of handles stocked for immediate shipment. Various types of valve handles and control knobs are illustrated. The company also supplies other types of valves not listed in the book.

★ A NEW CIRCULAR HAS JUST BEEN ISSUED BY THE Minnesota Mining & Manufacturing Co., St. Paul, Minn., on modern methods of sanding glass with abrasives and water as a lubric to eliminate scorching, chipping and dust.

★ A NEW ILLUSTRATED CATALOG COVERING SOUTH Bend 9-in. Precision Lathes, Models A, B, and C, has recently been announced by the South Bend Lathe Works. Two new models of the 9-in. Precision Tool Room Lathe are described in this 56-page catalog, as well as the 26 other types making up the balance of the 9-in. line. Among the uses for these lathes are production operations on precision parts and tool room work. Each one of these lathes is designed to handle a wide variety of work, and the information given permits the selection of the type that is best suited to the work. All attachments, tools and accessories for use with these lathes are shown.

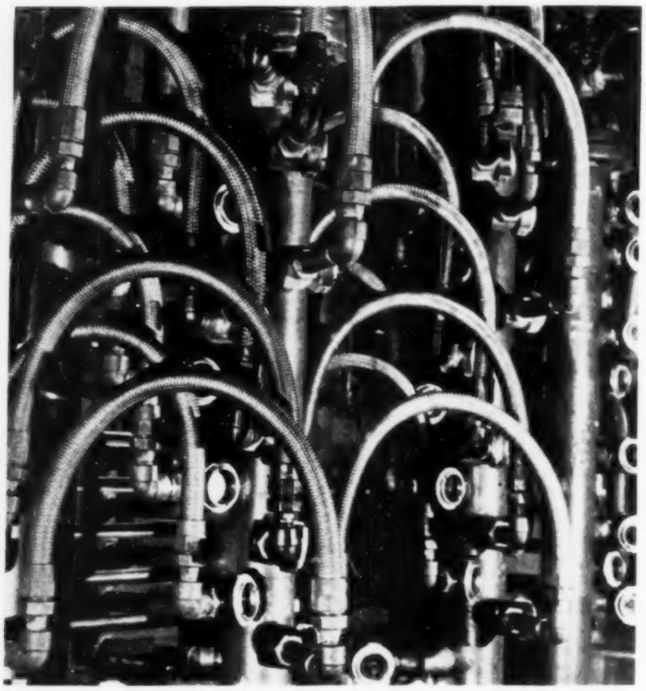
★ A NEW 60-PAGE CATALOG CONTAINING FULL INformation on the entire G-E line of insulating materials has been published by the Glyptal and insulating materials sales section of the General Electric appliance and merchandise department, Bridgeport, Conn. The catalog lists prices, and describes hundreds of items, including different varnished cloths, varnishes, Glyptals, tapes, cords, sleeves, varnished tubings, mica materials, wedges and soldering materials. Considerable technical data have been included in the book, dealing with manufacturing processes and tests, and many of these are fully illustrated. The construction of materials and their sizes are given.

★ RECENTLY ISSUED IS THE NEW THERMOCOUPLE Data Book and Catalog by the Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill. It is one of the most complete compilations of data published for thermocouple users. Page 32, for example, contains such valuable information as temperature conversion tables, millivolt tables, pipe and wire sizes, decimal equivalents, wire resistances, recommendations for checking thermocouples, and pyrometers.

★ "HOW TO GET ALONG WITH LESS PRIORITY Metal" is the timely and vitally important theme adopted by Metallizing Engineering Co., Inc., Long Island City, N. Y., in the most recent issue of Metco News. This 16-page book shows how it can be done with the metal spraying process—especially in the production and maintenance of rotating and reciprocating mechanisms. Many actual instances of unusual savings, not only in metal but in time and money as well, are described in detail and illustrated with photographs and diagrams.

★ VAN DORN PORTABLE ELECTRIC TOOLS, TOWSON, Md., has issued a 64-page catalog which is fully illustrated and contains prices and specifications of all products. Among the tools shown are drills, hole saws, tool chests, screw drivers, nut runners, tappers, hammers, saws, bench grinders, portable grinders, sanders and buffers. *(Please turn to page 88)*

Machinery and Equipment



★ PACKLESS METAL PRODUCTS CORP., HAVE DEVELOPED a new design in Flex-Controls required in platen press operation (above). The improved, sturdy steel arm supports embodied in these Flex-Control assemblies give more efficient and longer service of packless seamless flexible bronze hose with high-tensile bronze braid and detachable couplings, due to the automatically equalized distribution of flexing.

The self-draining flexible hose prevents steam losses and eliminates slack and pockets, together with many items of maintenance expense. Installation above shows flexible bronze hose and couplings on Baldwin-Southwark equipment.

It speeds production and reduces the replacement of piping and servicing of swing and sliding joints. Flex-Control units are supplied with flexible hose and couplings having inside diameters of $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$ and $1\frac{1}{2}$ inches. They are particularly adapted for presses used in the manufacture of plastics.

★ A NEW 230-VOLT INDUSTRIAL MULTI-BREAKER available at little more than the cost of a type A switch, is announced by Cutler-Hammer, Inc. This new breaker affords exceptionally economical application as a motor circuit switch or service disconnect switch. It is fuseless, with bi-metallic strip actuation, visible trip indication and trip free lever. It has a rated capacity of 230 volts from 15 to 100 amperes; available in 3 pole, 3 pole solid neutral or 4-pole solid neutral types. Calibration is set at the factory and cannot be changed. The breaker is completely enclosed and semi-dust-tight.

★ ESPECIALLY DEVELOPED FOR THE STUDY OF plastics is the new Hardness Testing Instrument manufactured by the R. Y. Ferner Co. for metals, plastics and industrial materials. It operates on the dynamic principle. The instrument is simply held against the piece to be tested and then the pendulum hammer is released by means of a pin on the rear of the instrument. Upon striking the piece undergoing test, the pendulum hammer rebounds carrying the pointer along with it to a point on the scale representing the limit of the rebound, thus giving an indication of the hardness of the material. Each Tester is furnished in a leather-covered case.

★ MEAD SPECIALTIES CO., HAVE BROUGHT OUT A new type of tool, the "Bandsander" for home craftsmen, hobbyists, pattern makers and work shops. It carves, shapes, sands, polishes plastic, wood or metal projects. When used for carving plastic jewelry, for example, one may expect fast, clean curves. The operation is followed up by a fine grit band and the edges are then ready for buffing. The "Bandsander" is a machine that fills an important need not met by any other piece of standard shop equipment. On wood and plastic work it fills the gap between the band saw and the final polishing operation on projects of almost any size or shape.

★ AN IMPROVED SOLENOID DESIGNED PRIMARILY for machine tool use is announced in a bulletin issued by the Johns S. Barnes Corp. It is said to have five important features. They are: (1) Unharmed by oil or coolant. The cloth taped coil is impregnated with oil and water resistant varnish; (2) feet and side plates integral and made stronger; (3) more and heavier rivets; (4) plunger guides made of phosphor bronze; and (5) mechanical structures made several times stronger.

★ SHELDON MACHINE CO., INC., ANNOUNCES THAT their new 11 and 12-in. lathes, with pre-loaded ball or precision roller bearing headstocks, will have a 1-in. capacity spindle hole having $1\frac{3}{8}$ in. diameter.

These new lathes will be moderate in price and will come in both bench and floor types with semi-quick or full-quick change gear boxes; with plain aprons or worm feed aprons; with power cross feed; with a choice of motor drives, including the Sheldon needle bearing over-head motor drive; and the Sheldon 4-speed lever, operated underneath the motor drive, entirely enclosed in a cabinet leg.

★ A NEW CLUTCH ON THE MARKET (ABOVE) THE Airflex, useful for industrial machinery, consists mainly of a ring-shaped rubber gland which is vulcanized either on the inside or outside to a torque transmitting rim. Upon air inflation it engages a concentrical meter drum, thereby establishing the driving connection. The clutch is flexible in every direction—torsional, lateral, angular and axial, thus combining the actions of a clutch with those of a flexible coupling. Operating air is introduced through a patented rotary air seal at the end of either driving or driven shaft. Among the advantages listed by the company is that they absorb torsional shock and vibrations and compensate for considerable misalignments of shafts.

IT TAKES A LOT OF "KNOW-HOW" TO MAKE THE MOST OF PLASTICS

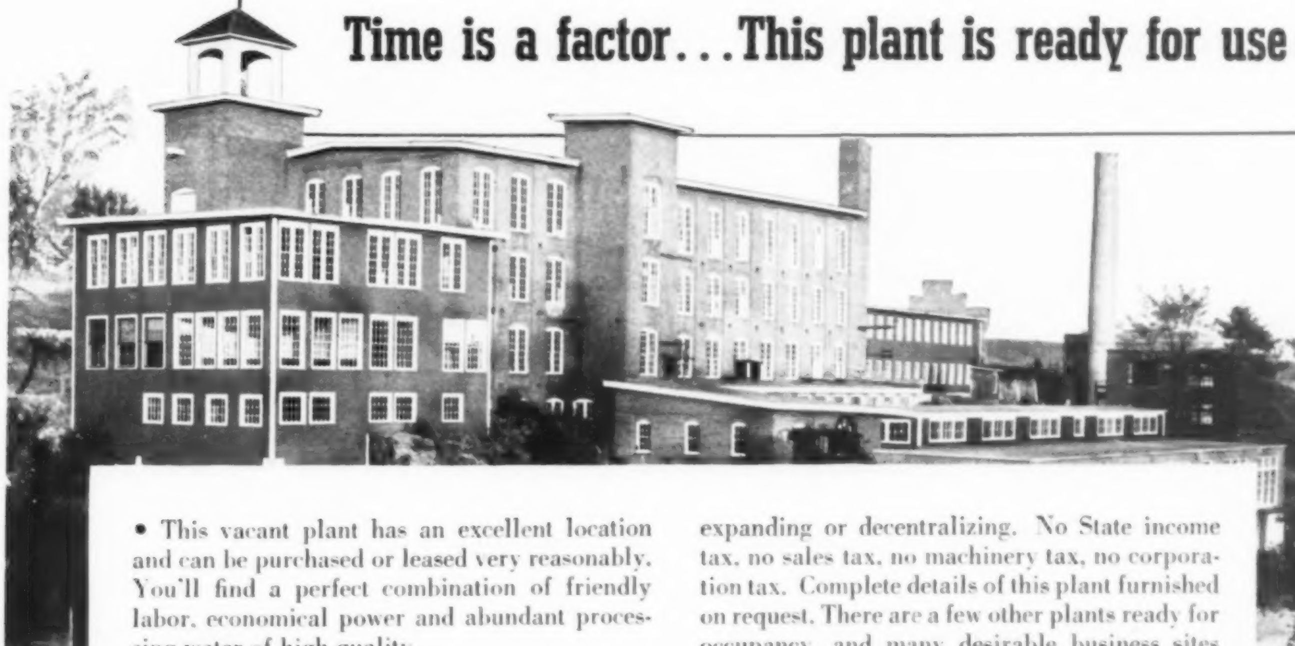
• A lot of plastics have gone through the presses since Kurz-Kasch started up in 1915. And those years have produced more than plastics—they've produced a lot of plain, old-fashioned "Know How". After all, you can't do anything as long as we've been doing this without getting handy at it.

Customers tell us that this specialized experience and skill is worth a great deal to them. Right now they are using it to facilitate emergency work—to plan new products—to prepare for the competition of the future—to keep abreast of the most tumultuous period in America's history. Letting us worry about the plastic end frees their hands and minds for other things. There's more than an even chance that we can do the same for you.

CALL IN KURZ-KASCH FOR PLASTIC PARTS!

KURZ-KASCH, INC., DAYTON, OHIO • Branch Sales Offices: New York, Chicago, Detroit, Los Angeles, Dallas, St. Louis, Toronto, Canada. Export Offices: 116 Broad St., New York, N. Y.

Time is a factor...This plant is ready for use



• This vacant plant has an excellent location and can be purchased or leased very reasonably. You'll find a perfect combination of friendly labor, economical power and abundant processing water of high quality.

This plant is in southern Maine — 15 miles from Portland harbor facilities. 120 miles from Boston. 24-hour freight to New York. Trucking service to principal eastern markets.

Maine offers much to manufacturers who are rushed with defense orders or moving, expanding or decentralizing. No State income tax, no sales tax, no machinery tax, no corporation tax. Complete details of this plant furnished on request. There are a few other plants ready for occupancy, and many desirable business sites available. State the requirements of your business. Address: Maine Development Commission, Room 591, State House, Augusta, Maine.

MAINE
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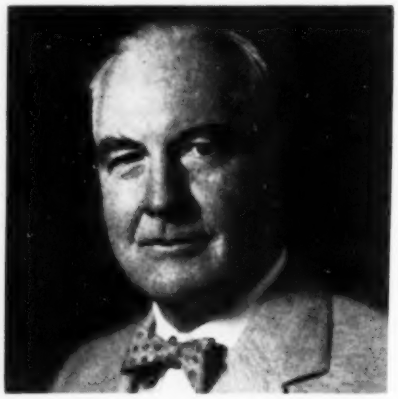
MAINE INDUSTRY

IN THE LIMELIGHT

★ ASSOCIATED ATTLEBORO MANUFACTURERS, INC., P. O. Box 628, Attleboro, Mass., have changed the name of the company to Plastimold, Inc.

★ MACK MOLDING CO., WAYNE, N. J., REPORTS THAT it is now extruding plastics in continuous length that can be made in almost any design, with or without fastening channels, or in tubing or strip. It is available in colors or translucent. It is claimed that there is actually no limit to the length that plastic can be extruded.

★ G. F. WAITE, FORMER SALES MANAGER OF THE Plastics Division of Firestone Rubber and Latex Products Co., has recently joined the Amos Molded Plastics Div. of Amos-Thompson Corp., Edinburgh, Ind., as sales manager.



★ GEORGE A. JOHNS HAS BEEN ELECTED PRESIDENT of the American Insulator Corp. of New Freedom, Pa., to succeed William S. Grove, resigned. Mr. Johns (above) has been associated with the company since 1926, and for the past few years has been vice-president and sales manager. Nelson E. Gage was made vice-president and general manager. He has a long record of successful business and manufacturing experience both here and abroad, his latest connection being Chrysler Export Corp., Antwerp, Belgium.

★ SUIT FOR INFRINGEMENT OF BUCHHOLZ U. S. patent No. 1,810,126, Jeffery patent No. 2,111,857, and Ryder patent No. 2,115,590, has recently been brought by Grotelite Co., injection molding machine manufacturer, of Bellevue, Kentucky, against Amos-Thompson Corp., plastic molder, of Edinburg, Indiana.

"The Buchholz patent is alleged to cover an injection process for molding of thermoplastics and the Jeffery and Ryder patents to cover certain specific features of injection molding machines.

"No interruption in the operations of Amos-Thompson Corp. is forecast by this suit and it is thought that the industry will be glad to see a determination of the questions of validity and scope of these patents. Several of the leading manufacturers of injection molding machines and of thermoplastic molding compositions will no doubt follow very closely the Court proceedings, and it is understood that the suit will be vigorously and ably defended on behalf of Amos-Thompson Corp. The latter company does not manufacture nor sell molding machines, nor does it manufacture the thermoplastic molding composition which it uses. It is understood that no suit under any of the above-mentioned patents has been brought by The Grotelite Co. against any manufacturer of molding machines or molding compositions."

★ DR. J. R. TOWNSEND, MATERIALS STANDARDS engineer of the Bell Laboratories, will speak Thursday Sept. 25, 8:00 p.m., at the Engineering Auditorium, 29 West 39th St., New York City, under the auspices of the Society of the Plastics Industry. He will discuss present-day molding materials, their characteristics and operation. Reservations should be made with the Society.

★ A NEW DEPARTMENT WHICH WILL BE KNOWN AS "The Fibron Division" has recently been formed by Irvington Varnish and Insulator Co. to deal exclusively with the extrusion of plastics. A new building at Irvington, N. J., with over 5000 sq. ft. of floor space, is being built for machines to handle the work. Products will be known as "Fibronized Plastics."

★ THE FALL MEETING OF THE SOCIETY OF THE Plastics Industry will be held at the Westchester Country Club, Rye, N. Y., from Oct. 12 to 14, inclusive. A program has been planned to include speakers in Government and industry for discussion of national defense and problems of the plastics industry. Leslie B. Gillie, chairman, Entertainment Committee.

★LYON IRON WORKS, MATERIAL HANDLING EQUIPment, Greene, N. Y., has changed its firm name to Lyon-Raymond Corporation. George G. Raymond, who has been president for the past 19 years, will continue in that capacity.

★ GERALD JOHNSON ASSOCIATES, 280 MADISON Ave., N. Y., announces change of firm name to Johnson-Cushing-Nevell, Product Design and Development, at the same address. The firm has designed for a number of large organizations including International Business Machines, General Electric Co., Emerson Radio, The Miller Co., and Simmons Company.

★ ANNOUNCEMENT IS MADE THAT THE ACKERMAN Rubber and Plastic Molding Co., 986 East 200th St., Cleveland, Ohio, has changed its name to The Ackerman Plastic Molding Co., for they have discontinued entirely the molding of rubber products. There has been no change in the personnel.

★ GEORGE MENDENHALL, INDUSTRIAL DESIGNER, has opened his own office at 43 East Ohio St., Chicago, Ill. Mr. Mendenhall had 4 years' experience in practical plastic designing with Barnes and Reinecke, industrial designers.

★ ERIE RESISTOR CORP., ERIE, PA., HAS ERECTED A new building to take care of its recent purchase of injection and extrusion plastic molding equipment. The building, east of the present group, is 30 by 150 ft. An additional 30 by 60 ft. will be built across the front for office space. The new building will house the entire Plastic Finishing Dept., the Drafting Dept. and offices of James P. Quinn, Sales Manager of the Plastics Div., and Lee Berry, Chief Mechanical Engineer.

★ FERRIOT BROTHERS, INC., PLASTICS DIE AND tool manufacturers, have moved to their new plant at 2685 Mogadore Road, Akron, Ohio.

★ THE NEW KODAK MINICOLOR PRINTS BROUGHT out this month by Eastman Kodak Co., have the "feel" of fine playing cards. Their base is opaque cellulose acetate plastic sheet instead of paper. Another development in photo color prints is the Kotavachrome Professional Prints, developed simultaneously with Minicolor, and a great aid to camera enthusiasts.

★ IN ORDER TO TAKE CARE OF A GROWING INdustrial demand for time control instruments, Paragon Electric Co., has moved its manufacturing facilities from Manitowoc to a plant with 25,000 sq. ft. of floor space, at Two Rivers, Wisc.

★ PULVERIZING MACHINERY CO., ROSELLE PARK, N. J., manufacturers of the Micro Pulverizer, have let building contract for a new modern factory and office building 100 by 200 ft., part two story on six-acre tract acquired at Summit, N. J.

(Please turn to page 86)

Mechanical tests of acetate

(*Continued from page 62*) Also the thermal conductivity of the material is low so that the heat could not be readily dissipated. The variation of test-section temperature with stress and also with the velocity of air movement over the specimen is shown in Fig. 7. It will be noticed that the temperature of the notched specimen at the root of the notch is higher than the temperature of the other shapes for corresponding stresses. This is to be expected since it is known that the effect of the notch is to produce higher stresses than that predicted from the elementary theory of flexure. At the endurance limit of both notched and square specimens an air velocity of 1000 ft. per min. was sufficient to reduce the specimen temperature to room temperature, at least on the side receiving direct impingement of the air blast from the fan. All specimens were weighed on an analytical balance both before and after fracture. In all cases the weight was found to have decreased 0.1 to 0.3 per cent. This may be due to the effect of the increased temperature. However, no detailed study of these data has been made. It is proposed to obtain endurance limits for specimens whose temperature is maintained at room temperature, but time has not permitted the completion of this work.

Mode of failure of cellulose acetate

Figure 8 shows the unusual (as far as metals are concerned) character of the fracture for several fractured specimens. During the progress of the tension test a considerable elongation and reduction in cross section of the specimen takes place. The character of the tension failure is unlike that occurring in any single metal in that both brittle and ductile properties are evidenced. The large elongation is evidence of ductility, yet it is not (as it is in metals) the result of sliding along planes of maximum shearing stress (at 45 deg.) as may be seen from the lime-coated specimen, Fig. 8 (a). It will be noticed that the lime cracked in transverse lines, beginning first at the corners of the specimen. Ductile steel would have shown diagonal cracks (Lüders lines) in such a coating. Further, there is no marked localized reduction of area (necking down); the reduction is uniform throughout the test section. The fracture is a transverse plane which is characteristic of the tension fracture of brittle materials, Fig. 8 (c). The fracture starts, perhaps at several places at once, as a tear originating at some slight surface imperfection which spreads leaving a shiny surface until rupture takes place. The surface of rupture shows a fibrous character.

In the fatigue tests, on the other hand, the fracture is propagated in a different manner. In the case of the circular specimens the plane of fracture was at 45 deg. to the plane of maximum normal stress indicating a shear failure as shown in Fig. 8 (b). Fracture of the rectangular specimens started in the same way but due perhaps to the shape of the specimen the fracture was a slowly propagating tear having the appearance of a glass-like fracture.

One single specimen has been tested in torsion and is shown in Fig. 8 (d). While there were no data taken on torque or twist, the test is of interest because of the fact that the specimen shown twisted around $1^3/_4$ revolutions before fracture started. This indicates large shearing deformation, but the fracture was on a 45-deg. helix (a plane of maximum tension stress). Thus again, ductility is indicated by the large detrusion whereas the fracture is that characteristic of brittle material.

Acknowledgments

Acknowledgment is made to F. B. Seely and H. F. Moore for their help and suggestions during the course of these tests and the preparation of this paper. A portion of the work reported was performed as a senior thesis in the College of Engineering of the University of Illinois by Kenneth Young under the direction of the author. The tests reported are a part of the work of the Engineering Experiment Station of the University of Illinois, M. L. Enger, Director, in the Department of Theoretical and Applied Mechanics of which F. B. Seely is head. Acknowledgment is also made to the Plastics Division of Monsanto Chemical Co. for the material supplied, and to the U. S. Soybean Laboratory at the University of Illinois for the loan of certain equipment.

Ford builds a plastic auto body

(*Continued from page 40*) is about 250 lbs. and the metal frame has a similar weight. In all, the car with plastic body weighs about 2000 lbs., while a steel unit of comparable size weighs approximately 3000 lbs. There are fewer drafts, though the body is as streamlined as its metal counterpart. Actually the first car represents a weight reduction of about 30 percent over a standard production model of the same type.

It has been a long haul from the "Tin Lizzie" to plastic panels and a great deal of time and money has been spent on years of experimentation before Mr. Ford showed the car to his Dearborn neighbors. In commenting on the motor car body, he said: "Plastic raw materials may cost a little more, but we anticipate a considerable saving as a result of fewer fabricating and finishing operations. For example, the relatively simple rear compartment door when made of steel requires no less than 7 stamping operations, while only 2 are required for the same panel made of plastic."

Long a believer that industry and agriculture are natural partners, Mr. Ford is particularly pleased at the new outlet for crops that the plastic body will give the farmer when it goes into production.

Company engineers said that no decision has been made as to what the standard power plant for the new model would be.

Even the windows and the windshield were of acrylic sheets, a composition used in the observation stations of modern bomber planes.

Shear strength of molded plastic

(*Continued from page 64*) measurements made at that one location for all of the compositions molded. Good comparative results were obtained upon all of the materials. These data as determined by the punch test are shown in Table I. Tests were performed upon all samples within 1 hr. after each molding.

All of the above tests were made upon materials molded in the same mold under pressures of 16,000 psi. in the plasticizing chamber of the injection molding machine. Injection molding temperatures for samples prepared for this test lay between 350 deg. and 370 deg. F., except for the polyvinyl chloride-acetate which was injection molded at 300 deg. F.

TABLE I. SHEAR STRENGTH

Material	Shear Strength, Psi.
Polystyrene (Monsanto Chemical Co.):	
As furnished	7,200
Molded reground stock	7,000
Ethylcellulose (Dow Chemical Co.), as furnished	7,600
Cellulose acetate-butyrate (Tennessee Eastman Corp.):	
As furnished	5,300
Molded reground stock	5,000
Cellulose acetate (grade MS) (Tennessee Eastman Corp.)	7,000
Polymethyl methacrylate (Röhm & Haas Co.):	
Hard flow	10,200
Injection molding grade	9,100
Polyvinyl chloride-acetate (Carbide and Carbon Chem. Corp.):	
Low molecular weight VG-5300	10,900
Medium molecular weight VG-5800	10,000

Variation of molding temperature and pressure, in particular upon polystyrene and cellulose acetate, showed negligible variation in strength even when molded, for example, at 5000 or 16,000 psi in the plasticizing chamber. However, in the region of the weld marks, shear strength was usually 10 to 15 percent lower than elsewhere in the molding.

Conclusions

For rapid, comparative tests of shear strength of plastic materials, the small punch and die method works quite effectively. Readings are usually made in less than 5 sec., and with the proper measuring apparatus will repeat with an inaccuracy not greater than 2 percent. Shear tests designed to show the influence of molding conditions upon thermosetting materials indicate quite clearly the degree of cure of the molding material. This test is further augmented either by boiling-water immersion of ureas for 10 min., or acetone immersion of phenolics for 10 min. Differences in shear strength as function of degree of cure are more pronounced under these conditions.

Concerning the effect of flow upon the shear strength, the phenolics tested gave very little variation in any of the specimens reproduced by the specially designed flow testing mold. However, it was interesting to note that a mold of this description affords a rapid method of comparing the flow properties of various thermosetting materials. The size of the orifices and the number of disks are both variables which distinguish between the various plastics with respect to their flow. Further tests are in progress to determine the efficacy of this unit as a simple, inexpensive means of comparing flow properties.

The data reported for shear strength of injection-molding materials afford a good comparison of the outstanding grades of thermoplastic injection-molding compounds, all of which were tested in the same mold under as identical conditions as possible. Inasmuch as the plasticizing chamber of the injection-molding machine was thoroughly cleaned out between each test, there was very little opportunity for impurities to affect the flow or physical properties of the material. Fresh, unopened drums of material were used.

Resinoid bonded wheels

(*Continued from page 42*) cular saws for cutting building stone are made with removable molded abrasive teeth, resinoid bonded. For cutting marble and granite architectural moldings, solid resinoid bonded abrasive wheels with the face formed to the reverse of the mold are ideally suited because of their fast cut, strength and surface finishing qualities.

Turning once more to the metal working industries, we find resinoid bonded wheels in common use for grinding and reconditioning the huge chilled iron rolls that fashion red-hot billets into sheets, rails and structural shapes. The ability of resinoid bonded wheels to take heavy cuts with an economical rate of wheel wear even at normal vitrified wheel speeds is the reason for their use here.

Other types of rolls such as alloy steel rolls for cold rolling strip stock, sheet and tinplate, require a roll surface free from chatters and scratches and other surface imperfections and, in some cases, a reflective or mirror finish. This flawless mirror finish has to be "built up" by a succession of progressively finer grit wheels. The final polishing wheel may be as fine as 500 grit and is usually resinoid bonded.

It may be said that diamond abrasive wheels bonded with resinoid have revolutionized the practice of grinding and sharpening cemented carbide tipped cutting tools. Tool grinders have been designed expressly for operating these diamond wheels. By greatly speeding up the sharpening of the carbide tools that are used for turning shell and other ordnance items, diamond resinoid bonded wheels are contributing indirectly to the nation's rearmament program. Their efficiency and economy of operation result from the fact that they are extremely fast and cool cutting, yet have a very low rate of wear. As a result, thousands

of carbide tipped tools can be sharpened with a single diamond wheel, say 6 in. diameter, $^3/_4$ in. face and having only $^1/_8$ in. depth of diamond abrasive.

Resinoid bonded diamond wheels, as thin as $^1/_{32}$ in., for 4 in. diameter, will cut through sections of hard cemented carbide in a fraction of the time required with steel or copper disks charged with diamond dust.

Other applications for resinoid bonded grinding wheels that might also be mentioned are saw-gumming, cutlery grinding, surfacing rail welds, smoothing structural welds and grinding automotive cams.

It is literally true that industrial progress, as we know it today, has been to a considerable extent dependent upon improvements in the department of grinding. Without modern grinding machines and grinding wheels, it would be impossible to machine and utilize present-day alloy steels and other hard metals. Only through their high accuracy coupled with mass production (which grinding alone can achieve at low cost) has the automobile, airplane, electric refrigerator and almost every contrivance developed for our living and transportation been brought within the means of the average family.

Industrial, electrical styrene

(*Continued from page 44*) contains a few percent of monomer and volatile constituent which boils at about 150 deg. C. since polystyrene is a thermal insulator, it loses its heat very slowly and must therefore be formed at above the boiling point of these volatile impurities. If the material is rapidly cooled upon formation into shape, the surface is hardened around a warm center due to the poor heat conductivity of the resin. When the warm center finally cools, it shrinks about 10 percent and exerts a great compressive strain on the already stiff surface. This action in turn leaves the center in high tension and, unless carefully controlled, actual tension failure occurs in the center creating a void or shrinkage bubble. Thus polystyrene will bubble if cooled too rapidly as well as if cooled too slowly. Chemically polystyrene is characterized by good stability as it is resistant to both weak and strong alkalis as well as weak and strong acids. However, strong oxidizing acids somewhat discolor polystyrene, although there is no apparent attack. In addition polystyrene is not affected by alcohols, paraffin hydrocarbons, waxes and vegetable oils. It is soluble in aromatic and chlorinated hydrocarbons and it also swells in ketones.

Polystyrene rods have been made for some time but recent improvements in production and in the raw material have resulted in a lowering of cost and a great increase in quality. Originally conceived for high frequency application, this rod form has, of course, received a tremendous impetus from the current emergency. In addition to utilization as coil forms, standoff insulators, coaxial cable beads and spacers, etc., the material is now being used extensively in the decorative field because of the high degree of clarity and its ability for use in end lighting display fixtures. A recent addition to the many uses of polystyrene rod has been in the chemical field where resistance to acids, alkalis and alcohols has been of invaluable aid.

The properties of polystyrene rod may be varied, as polystyrene belongs to the class of plastics, the physical properties of which are changed or modified by the forming process. If the material is stretched while it is cooling, the strain becomes permanently frozen into the plastic. These strains are greatest on the surface of the rod and are accompanied by a molecular orientation. When the plastic has a well-oriented structure, it is stiffer, possesses less cold flow, is stronger in the direction of orientation and is a great deal tougher than when orientation does not exist. The difference in strength of oriented and non-oriented rod is so great that it becomes apparent upon general handling of the rod. However, in uses where the rod will not be subjected to mechanical stress, the unoriented rod is superior because it may be bent, twisted or otherwise shaped when reheated. If an oriented shape is reheated, it will contract nearly as much as it was previously stretched during the manufacturing process and would not be useful where subsequent bending or forming operations are required. By control of the manufacturing process both types of rod may be produced.

In certain high frequency applications of polystyrene rod sufficient heat can be developed to cause softening and eventual failure of the piece. Recently a modified polystyrene rod in the process of development * has stood from 5 deg. to 15 deg. F. higher temperature than the regular polystyrene, depending primarily on the length of the period to which the unit was subjected to the elevated temperature. In addition, sheet made from this material has shown a lower flammability than regular polystyrene. This is a factor of importance in certain relay units.

Polystyrene sheet and foil have found large usage in condensers, insulating layers and protective coverings for high frequency apparatus. The material in sheet form has received considerable interest as a replacement for aluminum sheet and foil because of its surface hardness, dimensional stability and low water absorption. Many of the possible applications of sheet have not been explored as it is a relatively recent addition to the other standard polystyrene forms.

In addition to its excellence as a dielectric material, polystyrene sheet possesses great surface resistance to arcing and flashovers. It will depolymerize to the monomer at temperatures above 300 deg. C. and at these temperatures the resulting monomer is gaseous and by evaporation prevents surface carbonization.

The applications of polystyrene in sheet and rod form are constantly expanding. The properties of the material in these forms open many heretofore unexplored commercial possibilities.

Credits: Plax Corp., Bakelite Corp., Dow Chemical Co. and Monsanto Chemical Company.

* Styramic, Monsanto Chemical Co. Springfield, Mass.

CLASSIFIED

➡ WANTED: Injection Molding Acetate Scrap or Rejects in any form, including Styrene, Acrylic, Vinyl Resin Scrap materials. Submit samples and details of quantities, grades and colors for our quotation. Reply Plastics, 141 Halsey St., Newark, N. J.

➡ WANTED: PLASTICS SCRAP OR REJECTS in any form, Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Reply Box 318, Modern Plastics.

➡ 2 OZ. H-P-M INJECTION MOLDING MACHINE FOR SALE—Model #54, in excellent condition. Address Box 433, Modern Plastics.

➡ FOR SALE: 1—400 Ton Horiz. Hydraulic Extrusion Press. 1—Hydraulic Scrap Baler, 80 Ton, 6½" Ram, 90" Stroke, 5000 lbs. per sq. in. Large stocks Hydraulic Presses, Pumps & Accumulators, Preform Machines, Rotary Cutters, Mixers, Grinders, Pulverizers, Tumbling Barrels, Drill Presses, Lathes, Gas Boilers, etc. Send for Bulletins #156 and #138, and L-17. We also buy your surplus machinery for cash. Reply Box 439, Modern Plastics.

➡ WANTED: Stainless Steel or Nickel Kettle, Vacuum Pan, Hydraulic Press, Preform Machine and Mixer. Reply Box 275, Modern Plastics. No Dealers.

➡ FOR SALE: 12—30" x 40" platen, 500 ton Hydraulic Press; 1—W.S. 15" x 18" Hyd. Press, 9" dia. ram., 4" posts; 1—W.S. 24" x 48" Hyd. Press, 12" dia. ram. with hydraulic pushbacks; 1—46" x 54" Hyd. Press, 19" dia. ram; 1—Thropp 36" x 36" 4-opening Hyd. Press, 12" dia. ram; 1—Bethlehem 38" x 78" Hyd. Press, with 20" dia. ram; Birm. 16 x 36 Mixing Rolls, silent chain 40 HP drive; 1—Allen 16" x 42" Rubber Mill; 7—W. & P. Mixers; 1—Stokes "R" Single Punch. Send for Complete List. Reply Box 446, Modern Plastics.

➡ INDIVIDUAL PARTICIPANTS INVITED: Active: Productive: Financial: to discuss the possibilities of organizing a New Plastics Enterprise—Laminates—molded or extruding. Reply Box 461, Modern Plastics.

➡ WANTED: Experienced man in the Plastics Field. Established business requires man capable of assuming full responsibility of production operations, able to figure costs, experienced in mold design. Excellent opportunity for right man. Reply Box 462, Modern Plastics.

➡ WESTINGHOUSE CARTRIDGE HEATERS, 250 Watt, 110, 130, 220 and 240 Volt Brass cased, 13/16" diameter, 5" long. Close out price, $2.25 each. Electrical Heater Plates to order. Reply Box 463, Modern Plastics.

➡ FOR SALE: Two Foxboro controls for electric heaters as used on injection machines. Excellent condition. Attractive price. Reply Box 464, Modern Plastics.

➡ WANTED: Tablet Machines, all sizes: Hydraulic Presses: Hydro Pneumatic Accumulators. Reply Box 465, Modern Plastics.

➡ We are seeking a Chemical Engineer, experienced in diversified research in Thermo-Plastic, Thermo-Setting and Cold Moulding Compounds, on a consultive basis. Manhattan Modeling & Chasing Co., Paterson, N. J.

➡ WANTED: Chemical Engineer with Plastic Experience. Preferably with Ph.D. and Research experience in making and molding urea formaldehyde resins. The position open is in the development field and offers excellent prospects. Location Eastern Canada. Give detailed information regarding education and experience to which photograph must be attached and will not be returned. State salary expected. Reply Box 466, Modern Plastics.

➡ FOR SALE: Small, well equipped plastic plant located midtown Manhattan. Low rent—will sell reasonably. Reply Box 467, Modern Plastics.

Belt grinders

(Continued from page 46)

Unlike a disk or wheel grinder, a belt travels in a straight direction, with a uniform speed over its entire surface, thereby giving the work a uniform with-the-grain finish. Another example concerns an airplane manufacturer with a production problem of beveling the edges of a curved plastic wind-shield. The work had to be accurate because the beveled edge fitted into a slotted molding with a tight fit. Hand work to do this job required tedious, slow operations. They instituted the belt grinding method; within a few hours of instruction one operator turned the wind-shields out at the rate of 4 per hour.

Some manufacturers, especially in the cutlery field, have a combination of plastic and metal to grind down at the same time. With the belt method this is easily accomplished. Belt grinding machines are available in models for flat or curved surfaces, and by either the wet or dry belt methods. In conjunction with relatively new abrasives and belts, they offer utility and economy heretofore unavailable. Belt grinding is doing many things to speed production and reduce costs on a variety of materials.

Fluorescent laminates

(Continued from page 43) These new colors have the phenomenal property of connecting the invisible ultra-violet light into visible light. The ultra-violet light used is that in the range of 3600 Angstroms. These rays are outside of the erythrimal rays which cause sunburn and eyestrain. They are mainly above the visible range. To the eye they appear as a dark purple and are often called "black light." The light source is generally a mercury vapor lamp containing a blue ultra-purple filter screen. Development of these ultra-violet lamps is recent, and has made fluorescence commercial.

A search among the fluorescing compounds available proved that satisfactory compounds of both organic and inorganic nature could be used. The choice is a matter of light fastness, heat and chemical resistance, and fluorescent brilliance. After an exhaustive study a satisfactory group was found.

Some of these luminescing materials have the property of glowing only while being radiated with the ultra-violet light. These are called fluorescent. The other type which are phosphorescent continue to glow after the energyzing source has been removed. Both types are available in laminates and have a distinct place in the name plate field.

Urea-formaldehyde resin transmits the near ultra-violet light and is an ideal medium for these luminescing chemicals. The original development of fluorescent laminates by the Formica Insulation Co. was along decorative lines before the name plate type.

Credits: Bakelite, Formica.

No. 1 Electric Steam Table

In the limelight

(Continued from page 76)

★RELIEF FOR THE RADIO INDUSTRY FROM THE stipulations of the terms of the General Preference Order M-25, OPM, comes by way of collaboration of OPM and OPACS. According to Arthur E. Petersen, Consultant, Chemicals and Allied Branch, OPM, the folowing is the ruling in regard to the use of formaldehyde in the manufacture of radio cabinets:

"To the extent that plastics are available for the fabrication of Class II items, and subject to superseding priorities and contractural commitments on the part of the supplier, synthetic resin molding powder to a maximum of 75 percent of each radio manufacturer's requirements for molded radio cabinets for the month of September that were already covered by firm orders on August 23 may be delivered under a B-8 preference rating by the resin manufacturers for such use. Where radio manufacturers produce their own molding powder they may apply only 75 percent of the quantities of such resins that they had scheduled for this use prior to August 23. No radio cabinets may be made of cast resins that were produced or received subsequent to that date."

This will be reviewed about the middle of the month at which time the situation will be examined once again.

★ ELECTRIC REFRIGERATORS IN 1942 WILL HAVE more than 50 plastic parts, according to a survey by the Plastics Department of the Du Pont Co., among manufacturers.

A composite 1941 electric refrigerator has some 39 plastic parts and more than 77 possible plastic applications, the survey reveals. Refrigerator and plastics engineers already have developed a number of new plastic parts for 1942 models.

Their insulating value, economy, durability, new beauty, resistance to rust in a humid atmosphere and resistance to water make plastic materials particularly adaptable to electric refrigerators, engineers say.

Plastics have been used on refrigerators up to now because of their own superior properties. Now, due to the scarcity of aluminum, stainless steel, brass and other materials because of the defense program, the application of plastics on 1942 refrigerators (in so far as the supply of plastics will permit) is accelerated.

★ PLASTIC AND HARD RUBBER ARTICLES CAN NOW be polished economically and efficiently by means of a new synthetic wax, it is reported by Glyco Products Co., Inc., 230 King St., Brooklyn, N. Y. This wax, known as Albacer, replaces the carnauba wax used for this purpose, where a non-aqueous solvent is employed. One pound of Albacer, dissolved by heat in 2 quarts of Turkelene, gives a non-greasy, high polish on Catalin and similar plastic articles. Approximately 3–4 ounces in the standard 1½-bushel tumbling barrel is usually sufficient.

★ NINETY PERCENT OF THE TOOTHBRUSHES MANUfactured in the United States during 1941 for retailing at twenty cents or more will be bristled with nylon filament, it is estimated by the Plastics Department of E. I. du Pont de Nemours & Co. Nylon filament, a protein-like chemical substance synthesized from the elements of coal, air, and water, is a good example of American self-sufficiency, since imports of hog bristles from Siberia and China have become uncertain because of war conditions. Nylon also is said to be superior to natural bristles in wearing qualities. It absorbs only 20 percent as much water as natural bristle, and moisture does not soften the bristle appreciably, nor make it fall out of the handle.

★ GLYCO PRODUCTS CO., INC., HAS MOVED OFFICES, plant and laboratories from 148 Lafayette St., New York, to larger quarters at 230 King St., Brooklyn, N. Y.

SORRY !

ON PAGE 37 OF THE AUGUST ISSUE AN ERROR was made in describing the Vinylite Permocharts. These are non-flammable and are available for use for factory records.

Publications

(*Continued from page 72*)

★ MICRO SWITCH CORP., FREEPORT, ILL., IN AN attractive catalog, has issued detailed account of its precision snap action switches. It is actually a handbook of switches and contains characteristics, dimensions, prices and information as to the application of all stock switches, and additional information on special switches. The catalog is divided into sections according to the various classes of switches as follows: Bakelite switch, metal clad switch, LK Micro Limit switch, explosion-proof switch and switches for aircraft.

★ BULLETIN NO. 52, ISSUED BY ABBÉ ENGINEERING Co., 50 Church St., New York, illustrates and discusses its patented turbine sifter. This centrifugal sifting method produces clean, fast separation, saves power and space and eliminates shaking and vibration. Three types, Nos. 0, 1 and 2 are now available to those interested.

★ A 48-PAGE CATALOG DESCRIBING THE CONTROL instruments made by the Foxboro Co., Foxboro, Mass., has been issued by that company. The three different types of automatic controllers—open-and-shut, throttling and throttling reset—are discussed in the introduction. Illustrations and detailed descriptions follow.

★ PANGBORN CORP., HAGERSTOWN, MARYLAND, HAS issued a series of bulletins regarding the economies of controlling the destructive and costly waste of the "Dust Hog" (needless dust) in industry.

★ A CONDENSED CATALOG LISTING THE PRINCIPAL items of equipment manufactured by Wheelco Instruments Co., 1929 S. Halsted St., Chicago, Ill., has recently been issued. Among the pieces of equipment illustrated and described are: remote control auxiliaries, temperature control instruments, portable potentiometers and radiation heads.

★ A 7-PAGE FOLDER ON WALKER—TURNER FLEXIBLE Shaft Machines has been issued by the manufacturer in Plainfield, N. J. It is well illustrated with drill presses, lathes, grinders, radial machines, band saws, and surfacers. It is an excellent booklet for anyone looking for this type of equipment today.

★ THE REVOLUTIONARY ADVANCE IN RAYON YARN manufacture achieved by the introduction of the new continuous spinning and processing method and molded plastic spinning reels and buckets is graphically portrayed in an illustrated booklet, "Uniformity Rides the Reels," recently issued by Industrial Rayon Corp., Painesville, Ohio. The steps universally followed in converting wood pulp or other cellulose into viscose are depicted in the book. It includes a comparative flow sheet describing the several methods of viscose yarn production and reviews the particular characteristics of rayon fabrics.

★ THREE NEW INFORMATIVE BOOKLETS HAVE JUST been released by the Mill Supply Division of The Bristol Co., Waterbury, Conn. Bulletin 731 contains information on typical applications, types and sizes available, as well as prices applying. It is liberally illustrated. Catalog 846A contains a complete line of Socket Screws descriptions. They include Bristo set screws, cap screws, etc. Full specification details, prices, sizes and material are given as well as information regarding heat treatment of Bristo Socket Screw products. Catalog 572 is on Time Cycle Controllers. This gives information on tire presses, plastic molds, general process operations with illustrations to show principle of operation. Booklets will be sent on request.

★ THE NEW SPRING 1941 CATALOG OF THE CHEMICal Publishing Co., Inc., 234 King St., Brooklyn, N. Y., contains many important new titles. Books of importance in all technical and scientific fields, and to National Defense, have been added to the previous standard authoritative works.

(*Please turn to page 92*)

U. S. plastics patents

(Continued from page 68)

VINYLIDENE CHLORIDE. R. C. Reinhardt and J. H Reilly (to Dow Chemical Co.). U. S. 2,249, 915-6-7, July 22. Dispersions of polymerized vinylidene chloride, or its interpolymers with other olefin compounds, in a high-boiling aliphatic ether or a polychlorinated aromatic compound or a high-boiling ketone.

LINEAR POLYESTERS. C. S. Fuller (to Bell Telephone Laboratories, Inc.). U. S. 2,249,950, July 22. Making a polyester by continued esterification of ethyleneglycol or a homolog thereof with oxalic or higher dibasic acids.

MOLDING APPARATUS. Albert Henderson (to Wm. P. Witherow). U. S. 2,250,020, July 22. Apparatus having spaced bottom plates, side walls to form mold chambers, and movable end walls to subdivide the mold chambers.

PHONOGRAPH RECORD. Benj. H. Shuemaker. U. S. 2,250,140, July 22. Sound records are made of burl wood with a transparent playing face of a cellulosic lacquer containing beeswax.

RUBBER CHLORIDE. C. O. North (to Raolin Corp.). U. S. 2,250,232, July 22. Plasticizing rubber chloride in coatings with glycerol dichlorohydrin esters or glycol ether-esters.

RESIN FOR WATER PAINTS. Chas. Barrell (to Barrell Associates, Inc.). U. S. 2,250,346, July 22. A pigmented casein paint containing an alkyd resin as an additional film-forming compound.

ACRYLATE POLYMERS. C. T. Kautter (to Röhm & Haas Co.). U. S. 2,250,485, July 29. Polymerizing alkyl acrylates or methacrylates or their mixtures in presence of a catalyst by spraying into an inert gas hot enough to effect polymerization in a few seconds.

LENS. H. R. Moulton (to American Optical Co.). U. S. 2,250,597, July 29. A synthetic resin lens blank, hard enough to be polished like crown glass, is ground in such a way as to compensate for its difference from optical glass in refractive index.

REFLECTOR. Claude G. Bordeaux. U. S. 2,250,621, July 29. Embedding reflecting elements in a heat-cured Bakelite support.

MOLDING POWDER. J. M. Walter (to Imperial Chemical Industries, Ltd.). U. S. 2,250,662-3, July 29. Using triethyl or trimethyl phosphate as curing accelerator in urea resin molding powders.

FUEL PUMP DIAPHRAGMS. Wm. W. Watkins; Dorman McBurney (to E. I. du Pont de Nemours and Co.). U. S. 2,250,-664 and 2,250,674, July 29. A composition of polyvinyl alcohol and ethanol formamide; and a fuel pump diaphragm with high flexing resistance, made by impregnating fabric with polyvinyl alcohol plasticized with ethanol acetamide or ethanol formamide

ADHESIVE. G. L. Schwartz (to E. I. du Pont de Nemours and Co.). U. S. 2,250,681, July 29. Suspending starch in a polyvinyl alcohol solution to make an adhesive paste.

CORK ARTICLES. A. W. Bassett (to Armstrong Cork Co.). U. S. 2,250,697, July 29. Recovering natural resin from cork by treatment with superheated steam, and molding cork articles in a mold chamber into which steam is injected.

WATERPROOF FOILS. J. G. Evans and A. Shepherdson (to Imperial Chemical Industries, Ltd.). U. S. 2,250,929, July 29. Imparting water repellency and softness to extruded cellulose ester or ether foils by adding to the extrusion mixture a long chain alkyl or acyl derivative of an organic quaternary ammonium salt.

Publications

(*Continued from page 88*)

★ PRACTICALLY ALL ONE WOULD WANT TO KNOW about abrasives is contained in an informative little 20-page booklet called "The ABC and XYZ of Cleaning, Hardening, Surfacing, Relieving, Metal Fatigue, and Strain." It is given out with the compliments of The National Abrasive Co., Cleveland, Ohio. Drawings and charts illustrate the text.

★ COMPILED PRIMARILY FOR TECHNICAL MEN engaged in either pure or industrial research, "Metallic Soaps," published by the Metasap Chemical Co., a subsidiary of the National Oil Products Co., Harrison, N. J., contains convenient data, charts, etc., on the standard, well-known metallic soaps, as well as some not so commonly known.

★ NINETEEN NEW MODELS OF HIGH FREQUENCY electric tools are shown in the new THOR High Frequency Electric Tool Catalog, 1941 edition, issued by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. Considerably larger than the previous edition, the No. 61 contains a complete section of balancers and is fully illustrated by tool and action pictures, together with full specifications on all of the Company's high frequency electric tools.

★ GENERAL ELECTRIC CO., SCHENECTADY, N. Y., has issued 4 new bulletins: high-speed, synchronous motors are described and pictured in one; time switches for the automatic control of exhaust fans, pumps, blowers, mixing valves, filter cleaning and sign flashing are treated in a second folder; another describes a control for wound-rotor motors with emphasis upon problems involved in control for material-handling machines; the fourth booklet treats photoelectric relays and accessories.

★ BALDWIN SOUTHWARK, DIV. OF BALDWIN LOCOmotive Works, Philadelphia, has issued a 10-page, 2-color bulletin on its new Sr-4 bonded metalectric strain gage used for determining stresses in structures under difficult conditions.

★ A NEW SPIRAL BOUND BROCHURE RECENTLY published by Continental Machines, Inc., Minneapolis, Minn., is directed especially to trade and vocational schools, training centers and N. Y. A. headquarters and for apprentices who are being taught essential machining methods so they may take their needed place in defense industries. This brochure contains specification sheets on the various machines manufactured by this company, illustrations of the equipment and a selection of interesting letters from users of these machines.

★ A NEW 28-PAGE CATALOG, DESCRIBING A COMplete line of agitators, mixers, digesters, kettles, ball mills and pebble mills has just been issued by the Process Equipment Division, H. K. Porter Co., Inc., 4956 Harrison St., Pittsburgh, Pa. Comprehensive specification tables are included with pictures and description of each piece of equipment, enabling the reader to determine speeds, sizes, etc., best suited to his needs. In addition to the descriptions of process equipment, one page is given over to industrial locomotives.

★ "BULLETIN NO. 41" HAS BEEN PUBLISHED BY Hardinge Bros., Inc., Elmira, N. Y., as the latest edition covering Hardinge precision collets for all makes of lathes and milling machines. The proper name for each type of collet; the maximum round, square and hexagon capacities; the major dimensions for identification purposes and prices are all clearly presented in the bulletin. Through the cooperation of the various machine tool builders, the bulletin gives complete up-to-date information on the correct collet adaptation for the different types of lathes and milling machines.

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